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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. NORTH ISLAND HILL COUNTRY.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

(6) Brown-top (*Agrostis tenuis*).*

IN the past few grasses have been more despised than brown-top, and even at the present time comparatively few people advocate its use. On arable land the name " brown-top " is anathema ; by its behaviour in that situation it is rightly included among the twitches. On short-rotation grassland soils it is blamed largely for the going-out of the better grasses and clovers—perennial rye-grass, cocksfoot, crested dogstail, white clover, &c.—and its presence there is often made the sole reason for the ploughing-under of the pasture. Again, on extremely poor soils where it mats and becomes sod-bound it is scorned and considered of no value.

In previous articles of this series I have endeavoured to show that the habitat range of the better species is limited to the better-class soils where the soil-fertility is high or moderately so. Between the cocksfoot, crested dogstail, Poa pratensis, and white clover soil-type on the one hand and the Danthonia pilosa and suckling-clover type on the other hand lies the brown-top type. On this soil-type brown-top is the best grass the farmer can use. No grass indicates the soil-type and the standard of soil-fertility better than does brown-top ; and the recognition of this fact, together with application by the farmer to the problem of changing this type so that brown-top dominance no longer is possible, affords one of the big forward grassland moves open to him at the present time. Aggressive as brown-top is, it is no match for strong-growing perennial rye-grass, cocksfoot, crested dogstail, and white clover ; but just so soon as these species show signs of weakening—in other words, so soon as they are inadequately fed—brown-top can beat them in production, and in virtue of this fact it is in a position in such a pasture sward to dominate the association.

* For a botanical description of brown top, and comparison with red-top and creeping-bent, see this *Journal* for February, 1924.

FIG. 105. SHOWING BROWN-TOP DOMINANT IN GRASSLAND.

Brown-top occupies a soil-type intermediate between the cocksfoot, crested dogstail, Poa pratensis, and white clover soil-type on the one hand and the Danthonia pilosa and suckling-clover type on the other. A little cocksfoot is persisting in the sward shown.

[*Photo by E. Bruce Levy.*

(Fig. 105.) By its growth it rapidly further depletes the soil of the available plant-food, and a further dwindling of the once dominant rye-grass, cocksfoot, crested dogstail, &c., takes place, until finally is seen the typically run-out brown-top pastures too frequently met with on easy ploughable country at the present time.

At this stage of the present series I wish to make this point perfectly plain. We have, as it were, come to the dividing of the ways. Just above the brown-top standard of soil-fertility is milk-production, be it of the dairy cow or of the ewe; below the brown-top standard sustained milk-production is quite impossible. The brown-top standard of soil-fertility, then, is the dividing-line between wet-stock farming and dry-stock farming, excepting perhaps for a very limited period in the spring when annual clovers are helping on the milk-flow.

The limiting factor in pasture-production, and one that can be made good almost immediately, is that of available plant-food. Virtually all those soils that run to brown-top are sufficiently moist to render available any artificial manure applied; hence I feel safe in asserting that wherever artificial fertilizers can be got economically on to the ground the manuring-out of brown-top and the manuring-in of rye-grass, cocksfoot, crested dogstail, and white clover is capable of accomplishment. That forlorn hope of wishing for something better than brown-top without doing anything to improve the conditions for plant-growth must be abandoned; it may be taken that once the average farmer understands better why brown-top comes in and fills the position previously occupied by the better species sown by him he will endeavour, as far as lies in his power, to so manage the conditions that the grassland habitat may remain one for the better species to continue to thrive in. The manuring-out of brown-top and the manuring-in of rye-grass, cocksfoot, crested dogstail, and white clover should be regarded as a grassland maxim. (Fig. 106.)

The important fact for every farmer to bear in mind is that in the case of ploughing up a paddock predominantly brown-top and sowing it down to grass again, unless subsequent and regular top-dressing is done, as soon as the ameliorating effect of cultivation and of the manure applied at the time of sowing wears off, natural equilibrium between the pasture growth and the natural plant-food resources of the soil will soon come about, and in some three years' time the pasture will once more run to brown-top. These two truths—(1) that brown-top can be manured out, and (2) that soils running to brown-top dominant have become too poor for rye-grass, cocksfoot, crested dogstail, Poa pratensis, and white clover—are fundamental, and their recognition should go a long way towards putting grassland farming on second-class soils in a much better and more lucrative position. The actual cost of raising the fertility from brown-top to, say, rye-grass and white clover standard has not yet been determined, but it is hoped almost immediately to initiate experiments for the determination of this point. I am inclined to think that the amount of manure necessary will not be alarmingly great, but that regular manuring will be absolutely essential.

Where the farmer is thrown back upon the natural plant-food resources of the soil—in other words, where it is uneconomical to apply manure owing to heavy transport charges, and where such weeds as

catsear, hawkweed, dandelion, rib-grass, plantain, selfheal, field-daisy, cudweed, &c., are on the increase in his pastures—there is no doubt in my mind that there is a place for brown-top, a place which no other grass now known in this country can fill.

The brown-top soil-type may be defined as moderately wet, often sour, rather cold and stiff, and low in available plant-foods. Among such are the consolidated peat-swamps, drained and consolidated pakihi, better-class gum-lands of the Auckland Province, typical short-rotation soils of Southland, North Otago, South Canterbury, foothills of the Southern Alps, Westland, Wairarapa, and Marton-Turakina district. Further, all hill country is comprised of various soil-types, among which the brown-top type figures more or less largely. On all the poorer types of hill country there is a phase in the succession from rye-grass, cocksfoot, crested dogstail, Poa pratensis, white clover, &c., to danthonia dominant where brown-top should figure as the dominant for a shorter or a longer period. (Fig. 108.) The present-day success of large tracts of hill country in the Wairarapa and other parts is due largely to the brown-top phase intercalated between the two other phases mentioned. Conversely, the failure of large tracts on the west coast of the North and South Islands is due largely to the fact that brown-top never has become firmly established on those areas. The running-out of the better grasses and their replacement by shade-creating weeds, such as bracken fern, hard fern, manuka, piripiri, &c., not only soon reduces the stock-carrying capacity but creates conditions wholly unsuitable for the incoming and successful establishment of danthonia.

For soils, therefore, where it is manifestly impossible to maintain the better grasses indefinitely brown-top should figure in the mixtures sown in order to take up the running as conditions harden, when the effect of cultivation, &c., wears off, or as soon as the ash of the primary burn disappears. It will seem a bold step to include brown-top in the seed mixture sown on ploughable country, but I firmly believe there would be a much lesser amount of weeds of the catsear and rib-grass type present in pastures to-day had some brown-top been used.

In 1921 the Department of Agriculture laid down at the Central Development Farm, Weraroa, a series of small plots, the mixtures containing perennial rye-grass and white clover as a base and one other additional species per plot. In one plot the mixture sown was perennial rye-grass, 15 lb.; white clover, 2 lb.; and brown-top, 5 lb., per acre. This plot was sown on good-quality soil, typically rye-grass and white clover standard of soil-fertility. Right from the time of sowing up to the present day perennial rye-grass and white clover have remained dominant, brown-top showing only in one or two weaker parts of the plot. On this soil-type brown-top could be quite eliminated from the sward with small amounts of top-dressing. Fig. 107 also depicts a similar state of affairs. This particular paddock is in Southland, on the farm previously owned by Mr. W. D. Hunt. It is on soil which in the ordinary course of events runs to brown-top in three to four years after sowing down with the typical short-rotation pasture mixture. The area was limed and top-dressed with phosphate regularly every three years, and at time of taking photo the paddock had been down for thirteen years and was dominantly rye-grass, cocksfoot, crested dogstail, Poa

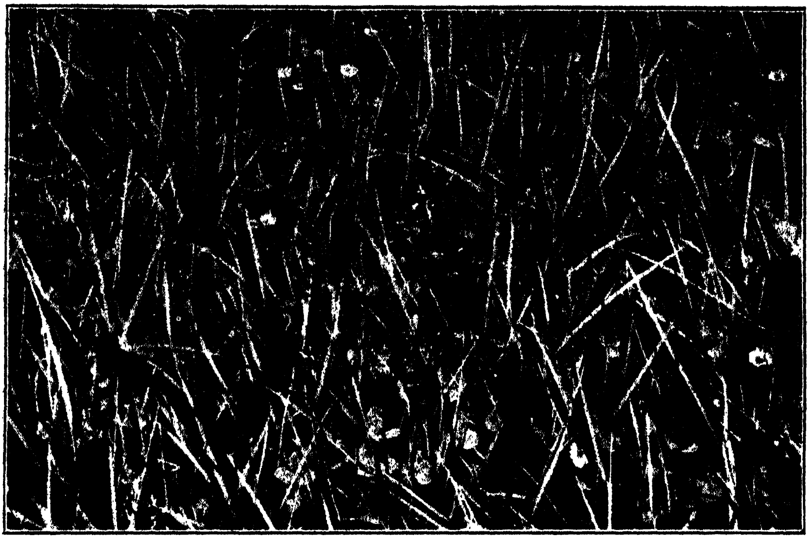

FIG. 106. PERMANENT PASTURE BROUGHT BACK FROM BROWN-TOP DOMINANT TO RYE-GRASS AND WHITE CLOVER DOMINANT BY TOP-DRESSING.

The manuring-out of brown-top and the manuring-in of rye-grass, cocksfoot, crested dogstail, white clover, &c., should be regarded as a grassland maxim.

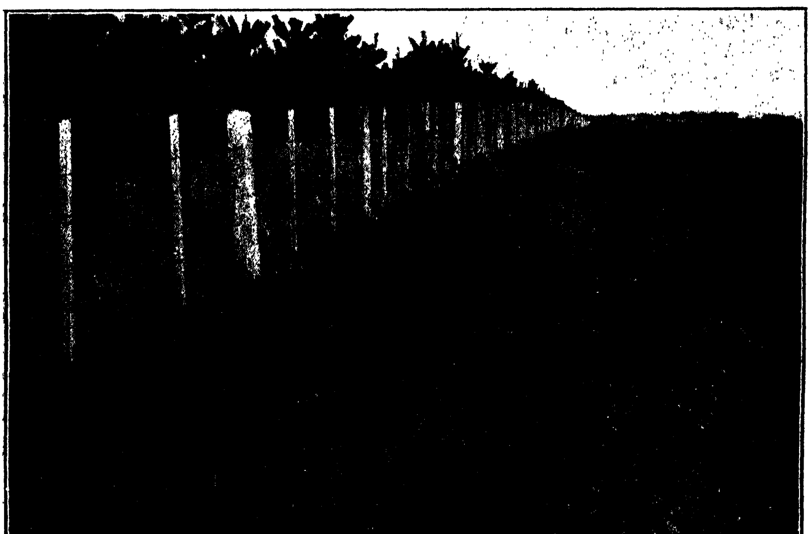

FIG. 107. EXCLUSION OF BROWN-TOP FROM SWARD BY MANURING.

On right, top-dressed pasture with rye-grass, cocksfoot, crested dogstail, Poa pratensis, and white clover dominant ; through fence, on left, where there has been no top-dressing, brown-top dominant. Pasture thirteen years old, and no spread of brown-top into the strong-growing sward.

[*Photos by E. Bruce Levy.*

pratensis, and white clover, while through the fence, where was originally the same turf, brown-top was dominant and seeding freely. These two examples serve to show that so long as the standard of fertility is kept up to the standard required by the better grasses and clovers brown-top may be sown in the mixture, or may seed freely in an adjacent paddock, yet it is impotent against the rye-grass, cocksfoot, &c., combination while these species are producing well and forming a closed turf.

A second experiment was carried out at Weraroa on the stony part of the farm, a soil-type much poorer than the one just referred to and off the typical rye-grass country. A general mixture of rye-grass, cocksfoot, crested dogstail, and white clover was sown, and on one portion a strip approximately 2 chains wide across the paddock was sown with brown-top additionally. In the first two years very little brown-top could be seen, and up to the end of the fourth year the brown-top confined itself to the sown portion. The growth was strong and an excellent seed crop of brown-top could have been harvested. After the fourth year brown-top spread at a great rate into the neighbouring weakened cocksfoot, crested dogstail, and white clover sward, necessitating ploughing up and resowing the area. The explanation of this behaviour, in contrast to that already cited on the better soil of the farm, is accounted for entirely by a change in the soil-condition. While the effect of cultivation and of the manure applied at time of sowing lasted, the rye-grass, cocksfoot, crested dogstail, and white clover were able easily to subdue the brown-top. At the end of the second year certain of this effect had worn off; the rye-grass first weakened and went out, leaving bare ground, and this ground rapidly filled with brown-top. In the third and fourth years rapid weakening of the cocksfoot, crested dogstail, and white clover followed generally over the paddock, and this weakening of the cocksfoot, &c., marked the rapid spread outward across the paddock from the sown brown-top portion. No top-dressing whatever was applied to this paddock, otherwise I feel certain there would have been quite a different story to tell.

The fact was mentioned that in the third and fourth years a good brown-top seed crop could have been harvested. In view of the possibility of working up a good export trade in the seed, this method of securing good clean crops of brown-top is worthy of some consideration; at the present time the best Chewings fescue seed crops are produced by the sowing-down of short-rotation pasture in which is included sufficient seed of Chewings fescue to give a complete cover as soon as the rye-grass, &c., goes out. At the present time it is from volunteer brown-top growth that the seed crops are produced; such growth for some years following on the short-rotation pasture is patchy, and it is not for some time that a payable crop can be produced. Then, again, the crop is somewhat uneven, as the first-formed patches have weakened somewhat, and consequently a less uniform line of seed is produced.

BROWN-TOP AS PIONEER.

Just as brown-top fills an important phase on most hill country in the succession from rye-grass, cocksfoot, &c., to danthonia, so it is found on very poor soils, or on soils the mechanical condition of which mitigates against rapid improvement to enable the better grasses and clovers to thrive, that brown-top comes in as a pioneer, and such

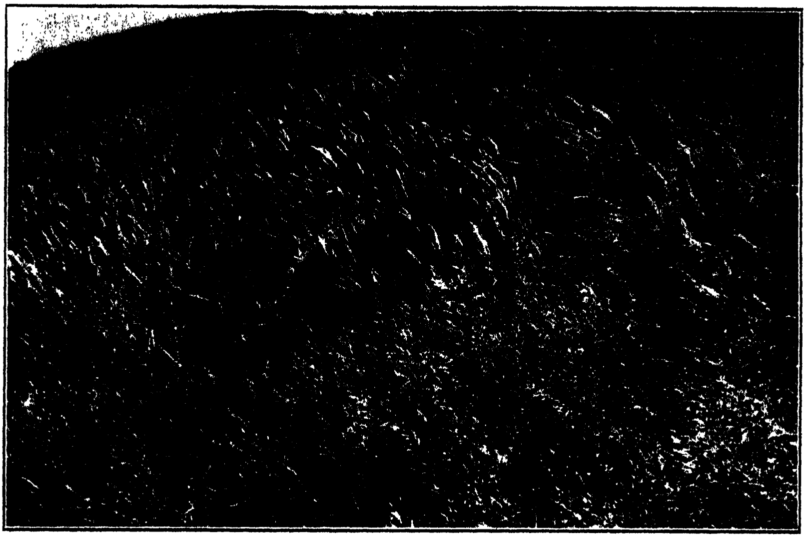

FIG. 108. BROWN-TOP PHASE IN THE SUCCESSION ON HILL COUNTRY.

The rye-grass, cocksfoot, &c., have almost entirely gone out. Brown-top is dominant in foreground, while in mid-centre and background Danthonia pilosa is dominant on a slightly poorer aspect. Photo shows well the habitat relationship between these two species.

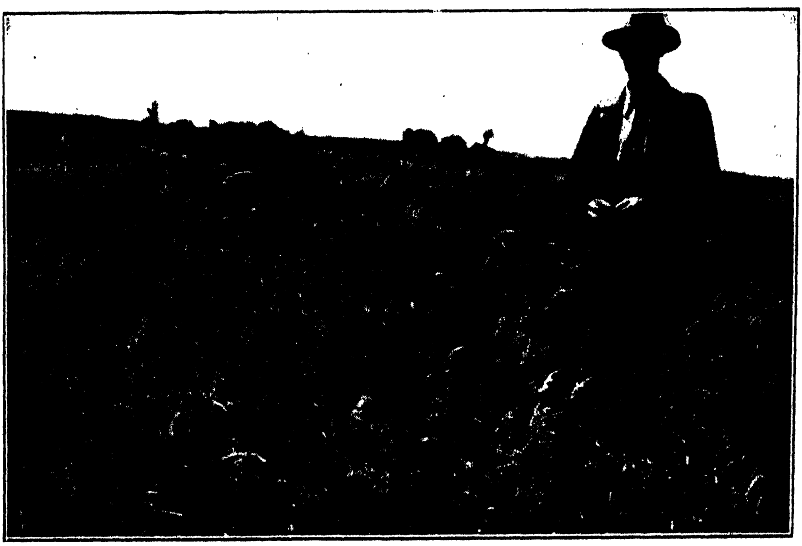

FIG. 109. MIXED PASTURE WITH BROWN-TOP AND LOTUS SPECIES DOMINANT ON TYPICAL GUM-LAND, NORTH AUCKLAND.

Such a sward can be cheaply secured by sowing down a mixed pasture and by subsequent applications of artificial manures. By its growth and productiveness it prepares the way for better-class pasture as humus content of soil increases and fertility is gradually built up.

[*Photos by E. Bruce Levy.*

soils by a gradual series of steps upward may ultimately be enabled to carry high-class pasture. Provided the rainfall is not a limiting factor, there seems to be infinite possibilities in the development of poor land that can be conveniently manured. But it would probably be expecting too much for such soils to rapidly build up to rye-grass, cocksfoot, &c., standard at the offset; rather should one first aim at a mixed pasture with brown-top dominant. (Fig. 109.) This can be secured at moderate expense, and with the brown-top pasture as a basis, after the accumulation in the surface layer of soil of a supply of humus, additional top-dressing is sufficiently effective to bring into being a sward with the better grasses dominant.

Such a succession is not possible, of course, unless a fairly good representative seed mixture is sown prior to the building-up of fertility. As an example of such pasture renovation and improvement I cannot do better than quote the case of Mr. W. P. Levy, in the Henderson district, near Auckland. His farm is on typical gum-land, the vegetation in the virgin state consisting of stunted manuka, Pomaderris phylicæfolia, Hakea acicularis, and in the more open spaces Danthonia semiannularis. In this virgin state the soil-type grades low down in the series, and when sown to grass and left unmanured the pasture rapidly deteriorates and becomes stunted, brown-top dominant, with danthonia increasing each year. Five years ago Mr. Levy started to work on such a worn-out stunted brown-top and danthonia turf. The first essential was to break the sod-bound turf by ploughing in narrow furrows, or by heavy disking followed by heavy tripod harrowing. (Fig. 110.) As soon as the soil was aerated in this way top-dressings of artificial manure were applied at the rate of approximately 2 cwt. per acre per annum. The first response to such treatment was a strong and vigorous growth of brown-top, Lotus major, and Lotus hispidus, and for three years payable seed crops of these were produced. With further top-dressing and tripod harrowing the composition of the sward changed considerably, and on the better portion of the farm cocksfoot, white clover, red clover, and even rye-grass grew so strongly as to render the area quite unsuited for brown-top-seed production. This season brown-top-seed production has been abandoned, and the area is now devoted to dairying. In my opinion there seems no reason why permanent high-class pastures should not be produced on this area so long as regular manuring and tripod harrowing are carried out. In this example is first seen the complete elimination of the danthonia and the rise to dominance of brown-top, Lotus hispidus, and Lotus major (harvested three years for seed), and finally the incoming of rye-grass, cocksfoot, and white clover additional to the brown-top and lotuses. It should be firmly borne in mind, however, that without the brown-top and lotus phase the rise to the better species dominant could not have been so economically effected. It is a question of building step by step, and one of those steps is the brown-top dominant phase.

In another respect brown-top is a good pioneer on certain soils that are loose and unconsolidated. By its underground root-stock it ramifies through the loose or peaty soil and helps to bind the soil together, and by its ability to produce feed stock are encouraged to tread and thus to consolidate the surface, all of which hastens the time when a seed-bed or growing-place is formed for the better grasses and clovers.

FIG. 110. REGENERATION OF SOD-BOUND BROWN-TOP BY PLOUGHING IN NARROW FURROWS.

Such practice aerates the soil, and the underturned turf when rotted provides increase of fertility for the surviving plants along edge of furrow. Excellent seed crops may be produced in this way. Subsequent heavy tripod harrowing and manuring will finally lead to an excellent pasture.

FIG. 111. BROWN-TOP POOR AND STUNTED ON LOW-FERTILITY SOIL.

On such soils the yield from brown-top is low, and soon a matted sod-bound stage is reached. Such stage is a clear expression of starvation conditions for brown-top.

[*Photos by E. Bruce Levy.*

BROWN-TOP ON VERY POOR SOIL.

If brown-top is sown on a soil below the brown-top standard of soil-fertility, or if the soil-fertility becomes depleted, this grass mats badly and soon produces that characteristic sod-bound state which has so often led to the condemnation of brown-top as a useful pasture species. (Fig. 111.) As in the case of Poa pratensis or paspalum, the sod-bound state is but a clear expression of starvation conditions as far as brown-top itself is concerned, and the remarks made concerning this state in paspalum pastures (see *Journal* for December, 1926, page 365) equally well apply to brown-top. Brown-top when sod-bound opens up somewhat and allows entry of species below it in the fertility scale, but, as one would imagine, the grass that is capable of entering and spreading within a sod-bound brown-top turf must be specially suited to an extremely hard set of environmental conditions. Suffice here to say that when brown-top mats and becomes sod-bound it is outside its habitat range and is on a soil-type for which certain other species are essentially more suited. Such species will be dealt with later.

BROWN-TOP ON ARABLE LAND.

On arable land specially set aside for annual crop production brown-top is one of the worst of weeds, and is well included among the twitch-grasses together with creeping-fog (*Holcus mollis*), old-man twitch (*Agropyron repens*), and Poa pratensis.* On such cultivated soils, even though within a comparatively dry region, brown-top may form very luxuriant growth on the cultivated field and yet soon fail on the same area when cultural operations cease and consolidated soil conditions again rule. Here under pasture conditions brown-top is obviously outside its habitat range, and I would not class these dry soils where top-dressing response is so very small as among those where stunted brown-top could be rejuvenated and the grassland improved, as in the case of the wetter gum-land area before cited. The cultivation of the soil increases fertility owing to the ameliorating influence of sun and air, and conserves moisture, so that brown-top may thrive well under such highly modified conditions, but when cultivation again ceases the water-holding capacity of the soil is greatly reduced and the soil-moisture content becomes a limiting factor. On such soils, then, permanent grassland of good brown-top or better type is almost out of the question, and hence such areas must be regarded as essentially suited to short-rotation pasture and annual crops. On such land brown-top is undoubtedly a bad weed.

BROWN-TOP AS A BINDING ELEMENT IN HILL-COUNTRY TURFS.

What has been written regarding the mechanical value of Poa pratensis in binding the turf (*Journal*, September, 1926, p. 149) may equally well be said of brown-top. There is one great exception, however—namely, that brown-top will persist and thrive on soils of moderately low fertility and retain a close and continuous cover, whereas Poa pratensis on such soils will dwindle and open up. Fig. 78 in the above-quoted issue of the *Journal* gives some little indication of the

* Methods for eradication of brown-top from arable land are given by F. W. Hilgendorf in "Weeds of New Zealand," pages 31–32.

FIG. 112. BROWN-TOP SPREADING INTO SOMEWHAT OPEN BRACKEN FERN ON SHADY SLOPE.

A certain amount of feed is produced under this condition, and stock are enticed to graze the area. Repeated firing or crushing to remove the shade of the fern also assists spread of the brown-top.

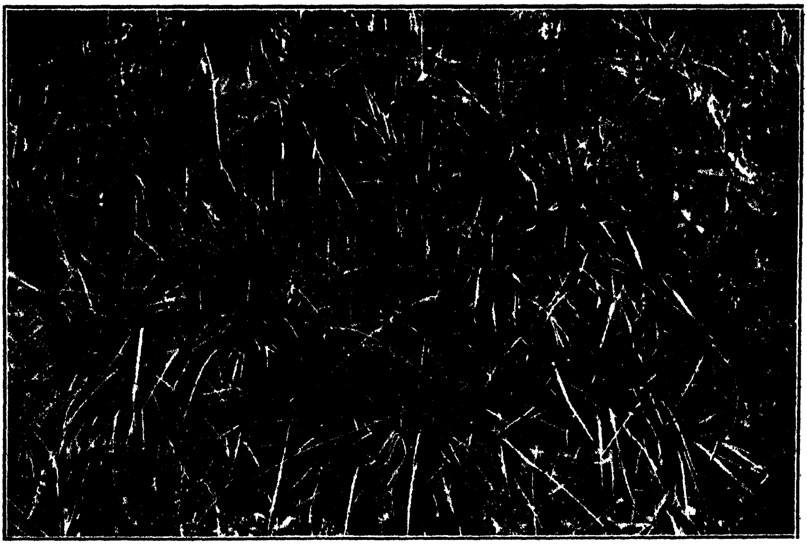

FIG. 113. BROWN-TOP RECOVERING AFTER BRACKEN-FERN FIRE.

Too dense a shade will kill the grass ; hence repeated firing or crushing of the fern is necessary in the initial stages to enable the grass to tiller and spread.

[*Photos by E. Bruce Levy.*

behaviour of these two species on the same rather poor soil-type. On the right of the photo Poa pratensis is seen dwindled and the turf opened up, whereas on the left brown-top is gaining in the pasture, forming quite a dense turf, and under these conditions is easily beating the Poa pratensis in production.

BROWN-TOP UNDER SHADY AND SECONDARY GROWTH CONDITIONS.

Brown-top is an excellent shade-endurer and ranks as the most important all-round grass for coping with secondary growth. What has been said of paspalum in the *Journal* for December, 1926 (pages 373–74), can equally well be said of brown-top, and this latter grass is not so limited in its distribution either in regard to the poorer soils or in its temperature requirement. Brown-top will thrive equally well in North Auckland and in Southland, at sea-level and well up mountain-slopes. Further, brown-top is capable of peculiar development under dense and tall shade. Normally the plant is capable of spread by means of underground stems, a fact that arable-land farmers know only too well. It would appear that under shady conditions the plant has the ability of converting these normally underground stems into aerial stems, which as they arise among the secondary growth give off lateral vegetative shoots; by this means the foliage is raised into the light, and as a consequence the normal living functions of the plant may be carried out.

In hill country it is on the shady slopes particularly that the value of brown-top comes in. The sunny slopes are easier to get into danthonia than are the shady ones. But brown-top being a better shade-endurer than danthonia can make headway into secondary growth on the shady slopes, provided that such growth is not too dense, whereas danthonia is impotent on such slopes. Large tracts of bracken-fern country in the southern part of the Nelson District are being brought back to grassland by means of these two pasture species. Danthonia is spreading into the weaker, more open fern lands on the sunny slopes, and brown-top is working similarly on the shady slopes (Fig. 112). These grasses working through the fern are a draw to stock; again, their presence there ensures better burning of the area, and after a fire gives a tasty bite; therefore stocking of these fern areas becomes more intensive, and, after all, as far as secondary growth is concerned, the matter is largely one of increased stocking for its control. The more stock, particularly cattle, that can be maintained (not starved) on an area, the better for the grass and the more likelihood is there of controlling the secondary growth. In Westland brown-top is also invading areas of the more stunted blackberry, and not only is it providing a draw to stock, but, as mentioned in the case of paspalum (*Journal*, December, 1926, p. 375), it helps to form a tight turf about the crown of the blackberry-plant, which aids greatly in control of the latter on steep unploughable country.

Brown-top carries a fire well, and recovers rapidly after burning (Fig. 113). No expense, therefore, is necessary in sowing further seed of this species on such a secondary-growth burn, which principle is indeed the very keynote for success in dealing economically with hard secondary-growth country (*Journal*, June, 1927, pages 368–69).

FIG. 114. BROWN-TOP SWARD GROWING ON PUKAHU ON PRIMARY BURN.

The better pasture species simply wilt off on pukahu areas, but brown-top, owing to its strong underground root-system, can persist. By its growth it encourages the treading of stock, thus consolidating the surface. After some years brown-top may mat badly on pukahu areas, but by its growth it has helped to keep out fern and to prepare the way for any danthonia established along with it.

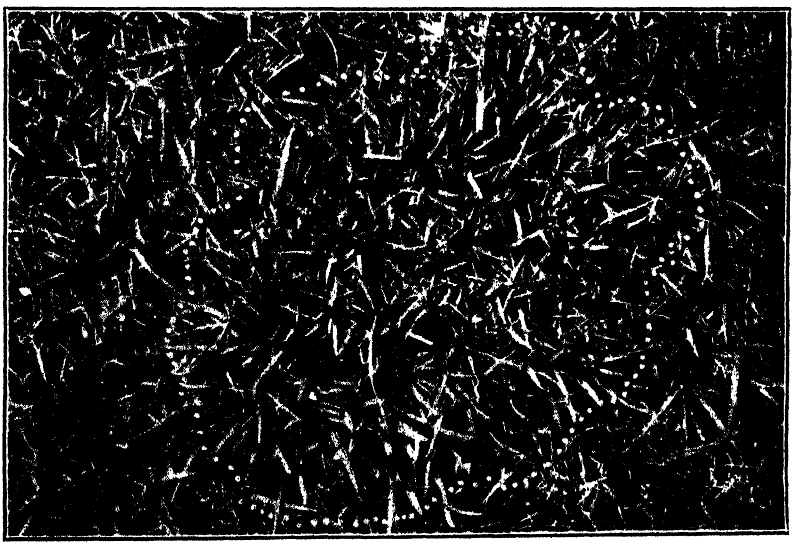

FIG. 115. BROWN-TOP MATTED ON PUKAHU AND BEING REPLACED BY DANTHONIA.

The large outspreading plant in centre of photo (enclosed by dotted line) is Danthonia pilosa spreading quite rapidly and replacing the stunted brown-top.

[*Photos by E. Bruce Levy.*

The final objective is to be able to burn off any secondary growth, or to crush it out and get a volunteer return growth of suitable species. Brown-top can well claim to be one of such species.

BROWN-TOP ON PRIMARY AND SECONDARY BURNS.

Brown-top should be included in all primary- and secondary-burn to grass mixtures. The plant readily establishes from seed, and in the first year it throws quite an appreciable amount of feed. On the primary burns it is seen at its best on the harder portions of the burn, where such species as rye-grass, cocksfoot, crested dogstail, &c., are not quite at home. By means of its creeping underground root-stocks it ramifies through pukahu and similar unconsolidated portions of the burn, and by its growth it serves as an inducement for stock, which consolidate somewhat by their treading these loose areas (Fig. 114). On richer portions of the burn brown-top is scarcely in evidence, being overcome there by the stronger-growing rye-grass, cocksfoot, &c. This is one of the conspicuous features of a new primary burn, and the patchy nature of the brown-top is apt to lead to the conclusion that the seed had been badly mixed or badly sown. But when such a case is examined carefully it is nothing more or less than an arrangement of the species among themselves according to habitat. Where the conditions are good enough for rye-grass, cocksfoot, &c., these will be dominant, and they will remain dominant just so long as the soil conditions remain uniform. But on the harder knolls, pukahu areas, &c., brown-top will be found dominant.

On all bush burns after a few years there is a general reduction of fertility over the whole area. On those portions where rye-grass, cocksfoot, &c., were once dominant there is an opening up, and such open spaces will be filled by one plant or another. If brown-top is established initially on the harder portions, seed shed from plants growing there will fall and germinate on these bare patches and fill them up, thus keeping a close and continuous turf. On the harder knolls and pukahu areas, which also become correspondingly poorer due to loss of ash, &c., the brown-top dwindles and in a few years mats and becomes sod-bound. This matting on the poorer areas often creates a bad impression in the mind of the farmer for brown-top, and he is often apt to recognize only these matted patches as that grass and to call brown-top growing stronger on a better portion of the burn one of the "English grasses," such as rye-grass or Poa pratensis.

It may be taken as a general rule that all that soil-type where kamahi, hinau, and rewarewa comprise the dominant forest-trees holds brown-top well, whereas the better grasses soon disappear. After some years on such a soil-type the brown-top may mat somewhat, but if danthonia is also in the mixture this matting on the harder portions is not a serious matter (Fig. 115) and must be regarded simply as the response of brown-top to the now poorer conditions ruling ; in other words, that particular aspect has become outside the habitat range for brown-top to thrive in.

Without some means of fertility maintenance on our hill country it would appear almost certain that the majority of the country is destined to run finally to danthonia, but even where a Danthonia pilosa sward is the objective the addition of brown-top to the original mixture sown is

FIG. 116. BROWN-TOP ESTABLISHED IN PATCH OF HARD FERN.

Once establishment is thus effected the area may be burned at any available opportunity, and it is quite unnecessary to sow any more seed of brown-top. This illustrates a fundamental principle in secondary-growth control.

FIG. 117. KNOLL WHERE HARD FERN HAS BEEN ENTIRELY REPLACED BY BROWN-TOP.

On the wetter bad hard-fern country this stage may take some time to reach, but the principle is sound. Photos of Figs. 116 and 117 taken on farm of Jepson Bros., Otaki Forks.

[Photos by E. Bruce Levy.

highly desirable. In a great deal of the wetter hill country, of the west coast particularly, the incoming of the secondary growth has been too rapid to enable danthonia to get a good hold before being smothered out. The ground surface becomes shaded by the secondary growth, and under shady conditions danthonia dwindles and then goes out. A sward of brown-top will help greatly to keep out the secondary growth. It will thus allow the light to reach the ground surface, and hence afford a better opportunity for danthonia established along with it to spread. Thus, even though the soil condition may ultimately become too poor for brown-top to thrive well, its presence prepares the way for spreading of the danthonia. For these reasons 1 lb. of brown-top seed per acre should be included in all primary-burn mixtures.

On secondary burns brown-top should be regarded as fundamental. It establishes rapidly, its cover cost is low, the seed is very small and thus escapes birds, it holds on almost any soil-type sufficiently long to enable danthonia established with it to become firmly rooted, and when it mats it opens up sufficiently to allow opportunity for shed danthonia-seed to germinate and to become established within it, thus ensuring a close and continuous turf right from the offset. The relative importance of brown-top on the secondary burn is shown very clearly in the tables printed in the *Journal* for March and June, 1927, recording the preliminary results of experimental sowing on secondary-growth country. An amount of 2 lb. per acre of brown-top seed should be included in all mixtures for secondary-growth burns where there is no brown-top showing prior to the burn ; but once this grass is well established on the area, in any subsequent burning done there should be no need to sow any more of it. When this stage is reached the area should be burned at every available opportunity until the secondary growth is entirely destroyed. Brown-top will come away strongly after each burning, but the hard fern, &c., will be considerably damaged each time, and as soon as one is able to weaken the fern the grass gets a better chance. The more compact the turf the poorer and poorer the fern growth becomes, until finally it is completely wiped out (Figs. 116 and 117).

CONCLUSION.

Ecologically, brown-top is one of the most interesting grasses, and from a practical standpoint the study of its behaviour is full of value. Occupying a position as it were on the border-line between two fundamentally different types of farming (wet-stock and dry-stock farming), naturally it is difficult to place an account of the grass before the farmer in the right perspective. On the one hand its incoming has been a boon for thousands of acres ; on the other hand its increasing dominance is a sign of insidious deterioration. Under one set of conditions every effort should be made to encourage its growth and spread ; under another set of conditions the effort in the future is to eliminate it from the sward—to manure it out.

Brown-top is an excellent indicator of soil-conditions, and really although very widespread throughout the country its habitat range as far as soil-type is concerned is not very great. The important point to get firmly established is the fact that its increase in the pasture is largely due to the conditions being unsuitable for anything better to thrive, and in its deteriorated state it is matted and sod-bound because it is starved. As a successional species on hill country it prepares the way for

FIG. 118. BROWN-TOP DOMINANT ON PRIMARY BURN.

The sward here seen shows a stage at which white clover, crested dogstail, and some rye-grass and cocksfoot are still persisting. Such a pasture is excellent for milk-production, and the brown-top will be found as palatable as any other species showing. At this stage very little manuring would be necessary to bring the sward back to dominance of the English grasses.

[*Photo by E. Bruce Levy.*

danthonia dominant on poor soils where fertility upkeep is out of the question, and in the breaking-in of naturally unfertile ploughable country it forms an important step in the succession upwards to rye-grass, cocksfoot, &c. If thriving well the grass is highly palatable when young, but as soon as it starts to get away rank stock neglect it almost entirely. Quite a small amount of fertilizer greatly increases its palatability, and when top-dressed to the stage where white clover and crested dogstail once more begin to associate with it this combination is excellent for milk-production (Fig. 118). When matted and sod-bound the herbage is quite unpalatable and the growth yield is exceedingly small.

Once more the plea may be made on behalf of our grasses and clovers to recognize that each has a definite habitat; each has a standard set of conditions which must be provided before that species can produce its best. It is for the farmer to provide the necessary conditions.

(Series to be continued.)

AGRICULTURAL LEGISLATION OF 1927.

(Concluded from December issue.)

F. S. POPE, Acting Director-General of Agriculture, Wellington.

ORCHARD-TAX ACT, 1927.

THE Act under which orchard-tax has been payable since 1917 expired on 31st December, 1926. The Act of last session was passed firstly to take the place of the defunct enactment, and secondly to enable a special tax to be levied in commercial fruitgrowing districts, in cases where the growers so desire, in order to provide funds with which to combat fireblight.

The provisions of the new Act, in so far as they relate to the general orchard-tax, are, however, somewhat different from those of the expired statute, the main points of divergence being as follows: Formerly the tax was at the rate of 1s. per acre, with a minimum of 2s. 6d. The new rate is 1s. per acre, with a minimum of 5s. and with an exemption for orchards of less than 120 trees. This will mean that owners of small orchards will not have to pay the tax at all. As a matter of fact, the half-crowns they paid under the old Act were almost swallowed up by the expense of collecting and accounting for them. As hitherto, the net proceeds of the general orchard-tax will be paid over to the New Zealand Fruitgrowers' Federation, for such purposes in furtherance of the interests of the fruitgrowers of the Dominion as may be approved by the Minister of Agriculture.

The special orchard-tax will operate only in those gazetted commercial fruitgrowing districts in which the Minister of Agriculture decides that it should be levied, and it must not exceed 5s. per acre. The net proceeds will be handed over to the Fireblight Committee of the district for expenditure in connection with the control of fireblight, including the cutting-down of hawthorn hedges, which are one of the chief means of spreading the disease, and which, in commercial fruitgrowing districts, have to be cut down in compliance with the Fireblight Act, 1922.

FUNGICIDES AND INSECTICIDES ACT, 1927.

The purpose of this Act is to give a measure of control over the composition of oils and chemicals sold for use in combating diseases of orchards and field crops, or for use as weed-killers. It has nothing to do with insecticides for the protection of human beings, nor with dipping-materials for cattle or sheep. The Act makes it an offence to sell any fungicide, insecticide, or weed-killer not up to the standard prescribed by regulations under the Act. The materials to which it will apply will therefore depend to a large extent upon the regulations that will be made after consultation with those interested. The Act, further, prohibits the sale of any fungicide, insecticide, or weed-killer bearing any false or misleading description.

INTRODUCTION OF PLANTS ACT, 1927.

There has hitherto been no legislation controlling the importation into New Zealand of plants not affected by disease, and it has consequently been open to any one to import plants that might later on spread and become serious pests. It is, of course, not advisable to control the importation of ordinary plants of kinds that are already commonly grown in or imported into the Dominion, nor practicable to regulate what might be called the accidental introduction of plant pests by such channels as ships' ballast, seeds in packing-material, or impurities in useful seeds imported ; nevertheless it was felt that steps should be taken to control the intentional introduction of new plants into the Dominion, and this Act was passed for that purpose.

The general purport of the legislation is to prohibit the importation of (*a*) any plant included in any of the schedules of the Noxious Weeds Act, 1908, or (*b*) water-hyacinth or any other plant named for that purpose by Order in Council ; and to provide that any person desiring to import any plant which, or any variety of which, is not commonly grown in or imported into New Zealand shall first obtain a written permit from the Minister of Agriculture. Had this Act been in force in the past, the introduction of such pests as blackberry and gorse might possibly have been prevented or delayed. Moreover, there are growing in other countries other highly undesirable plants which misguided persons might still wish to introduce into New Zealand, a procedure that can now be prevented if the law is adhered to.

It should be noted that no permit is required in the case of any new variety of such plants as apples, potatoes, wheats, roses, or chrysanthemums, seeing that other varieties of these are commonly grown in the Dominion. The Act is only applicable to plants, including seeds, in a state in which they are capable of growth. The Act also provides that if prohibited plants, or plants for which a permit is required, are received without having been ordered, they must be burnt, or a permit obtained, as the case may be.

SECTION 38 OF FINANCE ACT, 1927 (NO. 2).

This is merely a "machinery" enactment to authorize the Fruit Control Board to pay to the Fruitgrowers' Federation, as agent for the owners of fruit exported, moneys due by the Board to such owners under paragraphs (*d*) and (*f*) of section 30 of the Fruit Control Act, 1924.

STOCK AMENDMENT ACT, 1927.

This Act, as finally passed, deals with the three undermentioned matters only :—

(1) It repeals section 56 of the Stock Act, 1908, which section contained the law in regard to the recovery of stray live-stock, and substitutes provisions to the following effect : When an owner believes that any of his stock are in the possession of another person, or on such person's land, he may apply to an Inspector of Stock, and the latter may require the stock of such other person to be mustered on a given date for the purpose of handing over any belonging to the owner making the application. In the absence of the Inspector a constable may order the detention for not more than seven days of stock whose identity is in question. The Inspector, on application by the person receiving the notice, may postpone the time fixed for the muster. The person receiving the notice to muster, or order to detain, is entitled to recover expenses and compensation for damage from the owner making the application.

(2) It repeals section 4 of the Stock Amendment Act, 1913, dealing with registration of brands or marks used by stock-breeders' associations, and makes provision as follows : On the application of a breed society, testing association, or other society for the improvement of stock, the Director-General of the Department of Agriculture may register a standard mark to be used by such society to indicate that stock do or do not comply with its standards or tests. Any society eligible to register a standard mark may, with the Department's consent, brand animals under test so as to permanently identify each animal with the record of its tests. The use of any system by more than one owner for marking stock to indicate merit or test, unless the Department's consent to such system has been obtained, is prohibited.

(3) It provides that any person who with dog or gun goes on any private land without the occupier's authority and disturbs any stock depastured thereon may be fined up to £5 on the information of the occupier. This is a simpler means than existed previously for dealing with the disturbance of stock by trespassers with dog or gun ; but occupiers of land should note that they must themselves lay the information, and that it is necessary to prove that the stock were actually disturbed.

SLAUGHTERING AND INSPECTION AMENDMENT ACT, 1927.

This Act provides (1) that local authorities controlling slaughtering establishments may raise loans for additions to or reconstructions of existing or future public abattoirs without taking polls of the ratepayers on the subject, and (2) that meat slaughtered at the abattoir of one local authority and sold in the district of another local authority shall be liable to the payment of certain fees to the latter authority.

With regard to the first of these matters, the original Slaughtering and Inspection Act of 1900 made provision for the establishment of abattoirs—being a matter directly affecting the public health—to be carried out by means of a loan without a poll of the ratepayers ; but that Act omitted to make the same provision in regard to additions or reconstructions that would become necessary as time went on, and as the same reason applies—the public health—this omission has now been rectified.

The reason for the second part of this Act is that certain local authorities are obliged by law to make provision for public abattoirs for their districts, and it is therefore but reasonable that fees to provide for the overhead expenses of the abattoir should be paid on all meat sold in the district, even if the butcher selling the meat finds it advisable to have it slaughtered in the public abattoir of another district. The fees payable in such cases will, however, not cover the cost of the actual slaughtering and dressing of the meat.

APIARIES ACT, 1927.

This takes the place of the Apiaries Act of 1908 and the amending Acts of 1913 and 1920, and makes the following alterations in the law as embodied in those measures :-

(1) At present registration of apiaries is required in every third year. This is costly in clerical work and postage, and is somewhat of an annoyance to beekeepers. Under the new Act registration is intended to remain operative as long as the same beekeeper occupies the same premises and continues to keep bees thereon.

(2) Instances have occurred in which diseases (especially foul-brood) have been brought into clean districts owing to the removal of apiaries from unclean districts. This nullifies the considerable expenditure the Department of Agriculture is incurring in an effort to clear the country of bee diseases district by district. To meet this, it is provided in the Act that no beekeeper shall remove bees (unless they are sold) or used appliances for a greater distance than 10 chains without a permit from an Inspector. Arrangements will be made to grant in suitable cases permits to individual beekeepers covering the removal of their "out" apiaries throughout the season, so as not to cause unnecessary inconvenience.

(3) The Act provides for the condemnation of honey unfit for human consumption from any cause, and for the treatment or destruction of honey if there is reason to suppose that it is poisonous.

Wool-branding Fluids.—In his annual report for 1926–27 the Chief Chemist to the Department states: "Complaints having been made by woollen-manufacturers that preparations were in use for branding which were not removable by the usual scouring processes, samples of the branding-fluids on the market and of branded wool were submitted for examination. Several of the wool-samples contained coal-tar, but it was not found that this substance was an ingredient of any of the commercial fluids examined. Other samples of wool were found to contain thick masses of pigment that could only be removed by prolonged scouring or by a brief preliminary treatment with a suitable solvent. In such cases it would appear that the trouble complained of is the result of failure to keep the branding-fluid stirred while in use, resulting in some of the fleeces receiving a heavy brand of thick pigment from the bottom of the can. The investigation is being continued."

Actinomycosis.—The number of cases of this disease dealt with by the Live-stock Division throughout the Dominion in the year 1926–27 was 689, a decrease of sixty-five on the previous year. The cases were distributed as follows: Otago-Southland, 77; Canterbury-West Coast, 57; Wellington, 208; Auckland, 347. All live-stock inspection districts, with the exception of Otago-Southland, which shows an increase of twenty-four, shared in the decrease. Medicinal treatment is advised for this disease when detected in the early stages; as a result of such practice many animals have been saved from condemnation.

MINERAL CONTENT OF PASTURES.

PROGRESS OF THE NEW ZEALAND INVESTIGATION.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

THE investigation into the mineral content of pastures in New Zealand has gone steadily forward during the past year, being confined to those areas where deficiency disease due to pasture was definitely known to exist. The analyses of a series of red-clover samples are presented in this article, with a discussion as to the direction in which the results throw light. It is satisfactory to learn that the general conclusions reached several years ago as to the iron-deficiency in the pasture are borne out by the results of these analyses.

With regard to the occurrence of iron-starvation in countries other than New Zealand affecting animals whose sole diet is natural pasture, it is satisfactory to learn that the authorities in those countries are confirming our experience in the treatment of the disease. It was predicted in 1924 (" Transactions of the New Zealand Institute," Vol. 55, p. 723) that the " pining " disease of sheep in the Cheviot district, Scotland, the " coasty disease " of Tasmania, and the " nakuruitis " disease of cattle in Nairobi, British East Africa, would prove to be the same. This is now becoming verified. In the *Australian Veterinary Journal* for September, 1927, C. G. Dickinson, B.V.Sc., discusses " coasty disease " and finds that it yields to the same treatment as does " bush sickness " —the administration of iron and ammonium citrate. Mr. R. E. R. Grimmett reports from the Rowett Institute, Aberdeen, that the " pining " of sheep in Scotland is almost identical with the pining of sheep and cattle in certain parts of Auckland Province. He states that the citrate of ammonium and iron lick prescribed by the writer for the cure of affected stock is now being used on pining sheep in the Cheviots with excellent results, and is effecting rapid improvements. Mr. Grimmett further reports that the soil upon which pining develops in North Britain is of the same texture as our Mamaku soil—a sandy silt. The writer also learns that the nakuruitis disease in Nairobi, occurring on a soil derived from a light-grey volcanic ash, is similarly yielding to the medicinal treatment with iron ammonium citrate.

Methods of Investigation.

The composition of a fodder plant is influenced by three classes of facts (Warrington)—namely, those relating to (*a*) the age of a plant, or to the relative development of the parts, leaves, stems, fruit, &c.; (*b*) the composition and physical condition of the soil in which the plant grows, which includes consideration of the manuring and the climate; (*c*) the specific distinctness or the botanical relationship to other plants.

It is therefore desirable in studying the mineral composition of pasture to consider the effect of one varying condition at a time, the other conditions being as far as possible kept constant. Accordingly, in the following account, in an endeavour to arrive at the truth, the inquiry has been limited to three species of plants growing upon three or four types of soil in the same county on both manured and unmanured ground. The stage of growth has been limited to what is

known as well-grazed good cow-pasture, and the samples have as far as possible been taken throughout the whole year. The samples have been carefully selected by Mr. Grimmett or by the writer. They were cleaned of any sandy matter by quickly washing in water, a proceeding which may have resulted in loss of potash and soda, but these were not in any case estimated, and the error from washing in the constituents estimated is probably negligible. After drying, the samples were sent to the Department's Chemical Laboratory at Wellington, where they were carefully picked over, neglecting woody stalks and any material foreign to the species being analysed. In this way it is hoped that the botanical purity may be guaranteed, but that freedom from earthy contamination can be definitely assumed is more than can be hoped. In some cases earthy impurity seemed to adhere so tenaciously to the leaves that it could not be eliminated by washing. After air-drying, the samples were dried in the hot-water oven to a brittle state which enabled the portions to be broken in the hands to a state fine enough for 10 to 20 gram portions to be weighed with every probability of obtaining a fair sample.

In analysing samples of fodder plants it is desirable to establish the presumption that a sample is pure and free from such contamination of earthy particles as would appreciably affect the results of any analysis for mineral foods it is sought to estimate. This precaution is especially necessary in the case of elements such as iron and manganese, which exist to a much greater proportion in the soil than they do in the tissues of the pasture plant which lives on that soil. It is probable that ruminants cannot assimilate such mineral foods when they are present as earthy contamination. Such minerals, it is thought, must first be absorbed and be present in the tissues of the plant before the animal can absorb them.* Iron, for instance, may exist in amounts about 1 per cent. in a pumice soil, and is extracted by the hydrochloric acid used in dissolving the plant ash. The amount of iron (Fe) present in the tissues of dried grass is about 0.01 per cent., or one-hundredth of what it is in the soil. It will be easily seen that a very small contamination of the grass with soil will make a very large error in the estimation when the grass ash is analysed. Half a gram of pumice in one hundred grams of dried grass will therefore contribute as large an amount of iron as 0.005 per cent. to the assay, an amount as large as the grass tissue may itself contain, involving an error which therefore doubles the true iron content.

In order, therefore, to guard against the effect of an impurity which all the precautions taken in sampling have not been able to exclude, the results of analysis have been classified into "contaminated" and "uncontaminated" samples. In the contaminated samples the amounts of iron and of manganese have been given, but these determinations are not to be accepted as representing the natural ash of the plant. On the other hand, the determination of phosphoric acid and lime occurring naturally in pumice soils is so small that contamination does not contribute an error which will swamp general conclusions, and these may therefore safely be drawn from those determinations of samples contaminated by earth.

* Experiments with salts of iron in combination with mineral acids alone suggest that these are not so assimilable as those in organic combination.

In ascertaining from analysis what samples are and what are not contaminated, the writer makes use of two facts—the content of silica and the content of alumina. Silica is absorbed by grasses to a much larger extent than by clovers, so that a different standard is required for each class of pasture plant. When the amount of silica is greater than a certain amount it is valuable evidence of pasture contamination by earthy siliceous matters. The estimation of alumina is especially valuable as a method of determining the purity of a pasture sample. Aluminium always accompanies iron in New Zealand soils, but it is absorbed by the higher plants—to which the fodders belong—only in very small traces. Hence, if more than traces of aluminium are found in a solution of the ash of a pasture plant one may conclude that it is contaminated by earthy matter, and that the iron determination should be disregarded as probably much too high. Probably also the manganese determination will be in error from the same cause.* As to the manner of stating the results, and the methods used in analysis, the calculations are all stated as percentages of the constituent, calculated on the sample dried in the water oven until the loss on reheating was inappreciable. The method is in conformity with that used by research workers in other parts of the world, and in the writer's opinion is justified by his experience. The methods of analysis used are official or have stood the test of long experience in the writer's laboratory, and where any method was used other than that sanctioned by official publications it was checked by official methods by another operator.

Attention may again be drawn to the difficulty of obtaining a representative portion for analysis when dry grass or clover tissues of low specific gravity are contaminated with sandy or earthy material of much higher specific gravity. Contaminated samples must therefore be very carefully sampled, and in such cases check assays always made on duplicate weighed portions.

Notes on Results of the Analyses.

The aim in analysing the samples of pasture components was to obtain representative portions of the most commonly occurring plant staples in that condition in which they were actually being consumed by the ruminant. For the present the results reported only refer to cocksfoot-grass, red clover, and white clover. It is hoped to extend the work in the future to other species, to pastures as a whole, and to inorganic constituents other than those upon which the work has hitherto been done.

It should be premised that bush sickness does not in Rotorua County occur on land the topsoil of which is finer than a sandy loam ; further, that although the practice of applying fertilizers, the nearness of the water-table to the surface, the packing of soil particles by running or lake water, and the admixture of "humus" may convert a coarse pumice soil to a healthy one for stock, it will be well to regard all soil-types mentioned herein as suspicious except the external districts' samples and the sandy loams of those from Oturoa and Te Ngae. Another type of fine soil occurring in the Rotorua district is the silt

* This method was first used by the writer in investigating mortality in lambs in Central Otago. See this *Journal* for April, 1927.

Table 1.—Analyses of Red Clovers Uncontaminated and Unmanured.

Laboratory No.	Locality.	Date.	Ash.	CO_2.	SiO_2.	Fe_2O_3.	P_2O_5.	CaO.	MgO.	Mn_3O_4.	N.	Al_2O_3.	Remarks.
						Kapakapa, Mamaku, and Ngongotaha Mountain.							
T 1042	Mamaku ..	10/2/26	9·26	1·85	0·10	0·014	0·69	2·04	0·67	0·012	3·63	0·020	200-acre paddock.
W 851	Kapakapa Road ..	9/11/26	10·67	2·12	0·10	0·012	0·80	1·77	0·75	0·011	4·20	0·020	Highest part of road.
W 1202	,, ..	20/1/27	9·50	2·06	0·10	0·011	0·67	2·03	..	0·012	3·54	0·018	
W 1002	Ngongotaha Mountain	29/11/26	8·60	1·77	0·12	0·008	0·48	1·75	0·60	0·010	2·89	0·026	Summit of mountain.
W 1047	Kapakapa Road ..	14/12/26	8·01	1·97	0·09	0·010	0·58	1·87	0·65	0·010	3·23	0·010	
W 1196	Mamaku	12/1/27	9·31	1·97	0·11	0·009	0·62	1·71	0·81	0·015	3·23	0·019	
W 34	Ngongotaha ..	30/3/26	9·59	2·03	0·13	0·011	0·56	2·32	..	0·016	3·28	0·029	Hillside in bracken.
	Average ..	..	9·40	1·97	0·11	0·011	0·63	1·92	0·70	0·012	3·43	0·020	
						Ngongotaha.							
W 843	Streamside ..	3/11/26	9·99	1·82	0·14	0·016	0·93	2·08	0·71	0·010	4·67	0·019	Wet land.
W 1036	,, ...	10/12/26	8·92	1·86	0·20	0·016	0·72	2·31	0·91	0·008	3·33	0·025	
W 1300	,, ..	14/1/27	7·79	1·63	0·19	0·015	0·54	1·60	0·64	0·007	3·96	0·031	In flower.
	Average ..	..	8·90	1·77	0·18	0·016	0·73	1·99	0·75	0·008	3·98	0·025	
						Oturoa.							
W 1033	Muir's farm ..	10/12/26	9·69	2·06	0·15	0·010	0·58	1·82	0·61	0·017	2·96	0·023	
W 1303	,, ..	14/1/27	10·03	2·16	0·13	0·008	0·52	2·26	0·58	0·012	2·96	0·022	
W 246	,, ..	22/6/26	8·99	1·34	..	0·023	0·81	1·62	0·46	0·015	..	..	Three-year-old burn.
W 408	,, ..	22/7/26	10·01	1·08	0·18	0·016	1·05	1·34	0·69	0·016	..	..	
	Average ..	..	9·68	1·66	0·15	0·014	0·74	1·76	0·59	0·015	..	..	
						Te Ngae.							
2004	Gee's farm ..	7/4/27	10·69	1·84	0·21	0·021	0·88	2·01	0·70	0·012	4·74	0·030	

Table 2.—Analyses of Red Clovers, Contaminated and Unmanured.

Laboratory No.	Locality.	Date.	Ash.	CO_2.	SiO_2	Fe_2O_3.	P_2O_5.	CaO.	MgO.	Mn_3O_4.	N.	Al_2O_3.	Remarks.
						Oturoa.							
R 1085	Muir's farm ..	23/2/24	12·03	3·03	0·26	0·026	0·48	2·71	0·75	0·018	2·78	0·038	
W 839	,, ..	3/11/26	12·13	2·36	0·09	0·012	0·89	2·00	0·73	0·016	..	0·051	Elevated situation, growth backward.
	Average ..	..	12·08	2·69	0·18	0·019	0·68	2·35	0·74	0·017	..	0·044	
						Mamaku.							
W 40	Jackson's paddock ..	1/4/26	9·67	2·01	0·19	0·012	0·60	2·28	0·20	0·018	..	0·055	
W 42	200-acre paddock ..	10/4/26	9·47	1·90	0·12	0·013	0·61	2·08	0·77	0·016	3·85	0·070	
W 314	,, ..	22/6/26	..	..	0·26	0·015	0·89	1·25	..	0·014	..	..	
W 357	.. ..	19/7/26	8·33	0·89	0·40	0·022	0·94	1·18	..	0·010	..	..	Unimproved.
W 488	.. ..	18/8/26	8·89	1·15	..	0·013	1·02	1·33	0·41	0·011	..	..	
W 848	.. ..	2/11/26	10·53	1·83	0·22	0·019	0·84	1·90	0·76	0·018	4·33	0·038	
W 1038	.. ..	10/12/26	10·48	2·02	0·30	0·017	0·78	2·29	0·70	0·016	4·51	0·042	
	Average ..	..	9·56	1·63	0·25	0·016	0·81	1·76	0·57	0·015	4·23	0·051	
						Te Ngae.							
W 54	Smith's farm ..	5/4/26	11·48	2·55	0·54	0·028	0·55	3·19	0·63	0·022	..	0·053	
W 316	.. ..	25/6/26	9·09	1·31	0·57	0·022	0·79	1·26	0·71	0·012	..	..	
W 564	Gee's farm ..	28/8/26	10·89	1·68	0·45	0·032	0·98	1·71	..	0·010	4·64	..	
	Average ..	..	10·49	1·85	0·52	0·027	0·77	2·05	0·67	0·015	..	..	
						Kapakapa and Kaharoa.							
W 341	Kapakapa Road ..	8/7/26	8·61	..	0·43	0·013	0·76	1·05	..	0·011	..	..	
W 342	Kaharoa	8/7/26	9·04	0·95	0·83	0·040	0·72	1·64	1·13	0·026	..	..	Brain's farm.
W 561	Kapakapa Road ..	3/9/26	10·01	1·47	0·28	0·020	0·90	1·43	0·72	0·012	..	0·042	
	Average ..	..	9·22	1·21	0·51	0·024	0·79	1·37	0·93	0·016	..	..	
						Ngongotaha.							
W 311	Lakeside	23/6/26	10·20	..	0·37	0·016	0·78	1·90	0·82	0·034	..	..	Swampy paddock.
W 363	,, ...	23/7/26	9·78	..	..	..	0·81	1·68	0·78	0·035	..	..	
W 484	,, ...	19/8/26	10·95	1·35	0·46	0·021	1·02	1·54	0·80	0·029	..	0·036	
	Average ..	..	10·31	..	0·42	0·019	0·87	1·71	0·80	0·033	..	..	

soil of the Atiamuri Road; no pasture samples have been received from there, but it is known to be healthy country.

RED CLOVERS.

In the *uncomtaminated, unmanured* samples definite evidence is again obtained of the lack of iron in red clover, an important component of pasture on the pumice lands. The amounts of lime, magnesia, and phosphoric acid are fairly uniform in all samples. In the *contaminated* samples, although the iron results must be disregarded, the phosphoric acid, calcium, and magnesium results are valuable evidence. As one would expect, the amount of iron varies as the healthiness of the country; the healthier the country the more iron, the less healthy the less iron, in the samples.

The results of the analyses of white clover and cocksfoot samples will appear in succeeding issues of the *Journal.*

Explanation of Chemical Formulas, &c., in Tables.

" Ash " is the residue obtained on burning the dry matter in a porcelain basin over an Argand burner at the lowest possible temperature, and finishing the combustion in a gas muffle furnace.

CO_2 is the amount of carbon dioxide (carbonic acid gas) obtained on boiling the ash with dilute hydrochloric acid and absorbing the dried gas in soda lime.

SiO_2 is the total silicon dioxide (silica) obtained by dissolving the ash in hydrochloric acid, evaporating to dryness repeatedly, and separating by filtration.

Fe_2O_3 is the total amount of ferric sesquioxide (iron oxide) estimated by two methods.

P_2O_5 is the total phosphoric anhydride (anhydrous phosphoric acid) estimated by two methods.

CaO is the total amount of calcic oxide (lime).

MgO is the total amount of magnesic oxide (magnesia).

Mn_3O_4 is the total amount of manganoso manganic oxide (manganese oxide).

N is the total amount of nitrogen.

Al_2O_3 is the total amount of aluminium sesquioxide (alumina).

The words "manured" and "unmanured" are used to designate samples from land which has not been dressed with artificial fertilizers. In the classification of samples one cannot guard against the possibility of the samples having been manured by stock-droppings.

(To be continued.)

Poultry-farming.—Referring in his last annual report to the census of poultry in New Zealand the Chief Poultry Instructor (Mr. F. C. Brown) remarks: "The most gratifying feature in the returns is the increased number of people keeping large flocks, or, in other words, sufficient to provide the whole or greater part of a livelihood. In 1921 ninety-six people kept flocks ranging from 500 to 900, and forty-one kept 1,000 and over, whilst in 1926 there were 148 and sixty-six respectively. With the advanced knowledge now available relative to the breeding and management of large flocks, an extension of large plants may be looked forward to with confidence."

Tree-planting Companies.—Last year's annual report of the State Forest Service states that the boom in the formation of private and public tree-planting companies and syndicates, which commenced definitely in 1923, reached its climax in 1925, and only three new companies were formed during 1926. Of the thirty-six private and public companies registered in New Zealand, eighteen continued or commenced planting operations during the year, and established 51,242 acres in new plantations. Of this area, 50,937 acres were planted in the North Island and 305 acres in the South Island, bringing the total area planted to date to approximately 70,000 acres.

NAURU AND OCEAN ISLANDS PHOSPHATE.

THE INDUSTRY AND ITS FUTURE.

ALBERT F. ELLIS, C.M.G., New Zealand Commissioner, British Phosphate Commission.

THE steadily increasing exports of dairy and other agricultural and pastoral produce from New Zealand, with the consequent drain on the phosphate contents of our soils, is a subject which calls for careful consideration. We are in effect sending overseas each year thousands of tons of phosphoric acid, probably the most necessary constituent of soils in general, and one in which they are naturally low in most localities throughout this country. Not only must this phosphoric acid be replaced, but our "reverted" lands call for pressing attention, the large areas of second- and third-class lands have to be brought into productivity, the policy of closer settlement and therefore more intensive farming has to be further developed, and our large areas of sheep-country must be top-dressed. This all points to an ever-increasing demand for phosphates.

A few years ago the fact that New Zealand was not taking the quota provided for in the Nauru Agreement occasioned considerable concern, and the British Phosphate Commissioners had to seek outside markets to absorb the surplus production from Nauru and Ocean Islands. But the position is very different now, and the difficulty to be faced is how to cope with the ever-increasing demands of our Dominion and Australia.

During the last few years the consumption of high-grade phosphate in New Zealand has shown a progressive annual increase of well over 10 per cent. If this percentage of progressive increase continues—and from all appearances it will—the quantities which will be required in a few years run into very big figures. In Australia the rate of increase has also been rapid, and is expected to continue; in Western Australia it has gone ahead by leaps and bounds. There is reason to think that in a few years the two countries will be requiring over a million tons of high-grade phosphate per annum.

Already their requirements have exceeded the capacity of Nauru and Ocean Islands, and the question may well be asked as to the reason for this, seeing that the deposits there consist of about a hundred million tons. The actual position may be illustrated by imagining a number of thirsty individuals crowding round a large glass demijohn fitted with a very small mouth and containing water or perhaps something stronger. They want the liquid much faster than it can be poured out, but they have to be careful or the demijohn will get broken and its precious contents be lost.

Nauru and Ocean Islands, by reason of their very isolated and exposed position—without harbours or even anchorages, and subject at times to prolonged spells of bad weather—necessarily have their limitations. It is one thing to develop and carry on a great industry on the mainland, but quite a different matter to do it on two lonely islands in the centre of the Pacific, where problems have to be faced peculiar to the locality and the existing conditions. To unduly

augment the number of vessels arriving there, or to largely increase the labour force before such increase could be suitably employed, would speedily cause complications, bringing about results the opposite of what are desired.

At the present time the capacity of the two islands is about 550,000 tons per annum—though last year the 600,000-ton mark was almost reached—an equivalent of nearly one hundred large steamer cargoes. Particularly fine weather was experienced throughout last year, and there was a minimum of labour and other difficulties. For the previous year, when adverse conditions were encountered, the output was nearly 200,000 tons less, affording good evidence as to how the industry is affected by circumstances beyond human control.

The policy now being pursued by the Commissioners, with the full knowledge and approval of the three partner Governments, is to extend the shipping arrangements at both islands, introducing mechanical handling as far as possible, and also to develop the other plant to keep pace with the improved shipping facilities.

At Nauru a cantilever suited to the special conditions prevailing there is to be erected; it is anticipated that by means of a system of rubber-belt conveyors, which will take the phosphate from the shore bin to the end of the cantilever and discharge direct into the vessel's hold, it will be possible to load a 6,000-ton steamer in a day. This necessitates a great deal of plant development in the way of storage bins, artificial driers, cableways, Diesel engines for supplying power, tram-line extensions, further housing accommodation for the largely increased number of labourers, and so forth. A considerable number of men are now engaged on the preliminary work in connection with the cantilever, but two to three years' time will be required before the plant is ready for use

At Ocean Island an improved steel jetty of the existing type is being installed, and the storage, drying, and other production plant is to be correspondingly increased. To do all this development work on the two islands, and at the same time maintain intensive shipments, constitutes a very busy programme.

During the next three years New Zealand and Australia between them will require 100,000 to 200,000 tons more phosphate annually than Nauru and Ocean Islands can supply, and this deficit is being purchased by the Commissioners, on behalf of the manufacturers in the two countries, from the French island of Makatea, near Tahiti, and also from Morocco. The huge deposits in the latter country have been coming into increasing prominence during the last few years. Though the quality of these two phosphates is lower and the price is higher than that of Nauru and Ocean Islands, the much larger proportion used from the two latter evens up the business without materially affecting the price or the quality of the whole. The fact that the manufacturers have been able to maintain the high standard of the prepared fertilizers is very satisfactory; in a country where transport and handling expenses are heavy, material economy is effected by dealing with a highly concentrated article. In addition to purchasing these outside phosphates—which is being done for some years ahead—the Commissioners are endeavouring, and with some degree of success, to obtain options over further quantities, to be

exercised in the event of weather or other circumstances beyond control materially affecting the output from Nauru and Ocean Islands.

In all probability the benefit from the new plant installations at Nauru and Ocean Islands will be felt within two or three years, and ultimately it is hoped to work the output from there up to a million tons per annum under ordinary favourable conditions. In view of the natural difficulties to be encountered this objective must be considered a high one, and it may be mentioned that in the early days of the phosphate industry in the Pacific the objective set by the principal company then operating was 10,000 tons per annum, but even that figure was never reached.

Shipments of Phosphate by British Phosphate Commission to Australia and New Zealand since Business came under Government Ownership.

Year ended 30th June,	Australia. Nauru Ocean Phosphate.	Australia. Outside Phosphate.	Australia. Total.	Australia. Percentage.	New Zealand. Nauru/Ocean Phosphate.	New Zealand. Outside Phosphate.	New Zealand. Total.	New Zealand. Percentage.	Total for Australia and New Zealand.
	Tons.	Tons.	Tons.		Tons.	Tons.	Tons.		Tons.
1920–21 ..	265,914	..	265,914	93·96	17,100	..	17,100	6·04	283,014
1921–22 ..	171,286	..	171,286	81·65	38,500	..	38,500	18·35	209,786
1922–23 ..	203,446	..	203,446	79·78	51,550	..	51,550	20·22	254,996
1923–24 ..	320,031	..	320,031	84·02	60,850	..	60,850	15·98	380,881
1924–25 ..	337,298	..	337,298	77·34	98,790	..	98,790	22·66	436,088
1925–26 ..	273,511	53,510	327,021	73·66	97,960	18,977	116,937	26·34	443,958
1926–27 ..	463,090	76,966	540,056	78·45	130,250	18,100	148,350	21·55	688,406
Total, 7 years	2,034,576	130,476	2,165,052	80·27	495,000	37,077	532,077	19·73	2,697,129

The accompanying table sets out the shipments to Australia and New Zealand since the business came under Government ownership, and the rapid annual increases for the Dominion will be noted. Our manufacturers' requisitions for the current year are nearly 180,000 tons; and for 1928–29 there is another large increase, the quantity requisitioned being about 230,000 tons.

The approximate distribution of the last-named quantity is of interest. About 140,000 tons are requisitioned for Auckland, and about 25,000 tons each to New Plymouth, Wanganui, and Lyttelton, tapering down to a comparatively small requisition for farther south. The southern farmers consider this is evidence as to where the good land is situated, but their northern friends hold it is proof as to where the good farmers are!

Opossums and the Forest.—The generally held opinion that the opossum does little or no damage to the native bush is supported by the investigations recently made on beech forests for the Forestry Department by Dr. L. Cockayne, F.R.S., who has a comprehensive knowledge of the forests before and after the introduction of the opossum.

THE FEEDING OF LIVE-STOCK.

J. McLINDEN, M.R.C.V.S., N.D.A., Officer in Charge, Animal Husbandry Branch, Live-stock Division.

I. NUTRIENTS AND THEIR FUNCTIONS.

IN order to further supplement the educational work of the Live-stock Division a connected series of articles on the principles underlying the feeding of live-stock will appear in this *Journal.* No methods will be given showing a simple, easy way to success. The object aimed at is rather to indicate the necessary care and attention required from the farmer if he is to be really successful in obtaining the greatest returns with maintenance of health of the stock. By making clear the principles of feeding, those interested will be placed in a position to understand the requirements of their stock, and from the farming peculiarities of their own district how best to provide for them. It may occasionally be necessary to introduce simple rations as examples, but these must not be regarded as hard-and-fast diets and quantities. Any rations suggested will be based on averages of value to stock, and are to be taken only as a guide. Efficient though they may be, they must be fed, if used at all, according to the individuality of the stock receiving them. It is not intended, of course, to give elaborate rations of concentrated feeding-stuffs. Technical detail generally will be avoided as much as possible.

The whole endeavour of the farmer to-day is to produce, and to breed with that object in view. It is impossible to dissociate these two things—breeding and feeding. When animals are bred up to heavy production they must be fed in proportion to their capabilities. In order to exhibit their abilities the best of milk-producers require the feed to convert into milk. The same principle applies to pigs. No matter from how economical a strain they may be they will never fatten if not adequately fed. Domesticated farm-stock are living machines, converting vegetable materials (chiefly) into food suitable for human consumption. The more they are expected to give, the more and richer the crude products fed to them must be. Farm-stock convert food unsuitable for human consumption into suitable food.

Just as a particular engine requires a particular type of fuel—coal, petrol, or oil—so do live-stock require their particular type of food or fuel if health and function are to be maintained. This food is composed of two substances known as the carbohydrates—such as sugar, starch, fibre, &c.—and fats or oils. These substances form the energy-making part of a food. Although these materials are to be found in all farm crops—roots, tubers, and cereals—they exist in varying quantities. For example, the mangold shows a high sugar content, the potato and maize a high starch content, and hay a comparatively high fibre content. But the carbohydrates and fats do not account for everything required by the animal. The replacement of muscle waste is dependent upon other materials known as the proteins (sometimes called albuminoids or flesh-formers) — the white of egg, for example. Proteins are to be found in all plants in

varying quantities, but chiefly in clovers, lucerne, and other legumes Young grass contains a group of materials which for feeding purposes are grouped with the proteins. They are found in great quantity in young grass, and it is due to their action that this feed is so laxative.

The value of a feeding-stuff depends on the amount of nourishment which the animal is capable of digesting out of it. In practice that means that the farmer must have a rough idea how much value (no matter what quantity may be fed) any food will have to the animal. A great quantity of bulky food might be of less value than a few handfuls of oats. All the compounds found in feeding-stuffs need not be of value to the animal consuming them. Those constituents which may be of value are referred to as nutrients, and a nutrient may be defined as any constituent, or group of constituents, found in food-stuffs that may aid in the support of animal life. As already indicated, these groups are at present known as the carbohydrates, fats or oils, proteins, ash, and water. It is frequently convenient to group all these materials (except the water) together, when they are referred to as the dry matter. Two other materials—the vitamins and the pigments—must be mentioned, especially the former, because of the prominence which it is being given.

Nutrients considered.

Water.

Water is one of the most important component parts of all feeding stuffs. It varies considerably in amount; it may be as low as 5 per cent. in the concentrates (meals and cakes) and as high as 90 per cent. in roots. Water is absolutely essential to the animal; it performs more obvious functions than anything else. No matter of what origin, either as a food-constituent or as a drink, it aids the process of digestion, absorption, and transportation of nutrients, the elimination of undigested material in the dung, the elimination of waste products from the body as urine, and the production of milk in the female. Cow's milk contains 87 per cent. of water.

It is for this reason that roots such as turnips, mangolds, pasture, and silage prove so beneficial to dairy stock, which, more than probably, are being deprived of their full allowance of water. No doubt each food might have its own particular merit, but these would be very limited if water was withheld or curtailed. Great discussions are always readily started on this subject, especially when a comparison is being made between the value to the animal of plant-juices and good drinking-water. It would be absurd to ignore the value of plant-juices, but it would be much worse to ignore the necessity of a plentiful supply of a good wholesome drinking-water. Stock not provided for in this way always respond remarkably well once a good supply is installed. A good supply of water should exist in every paddock or shed holding stock.

Carbohydrates.

The carbohydrates constitute a very large group of compounds, and for feeding purposes they have been divided into two—the soluble carbohydrates, such as the starches and sugars, and the crude

fibre. They are stored in large quantities in all roots, tubers, and cereals, and, except the crude fibre, they are as a rule readily digestible by all farm-animals.

The soluble carbohydrates are all very similar. Starch is found most commonly in farm feeding-stuffs; in cereal grains it constitutes 60 to 70 per cent. of the soluble carbohydrates. Sugar is abundant in roots such as mangolds. In root crops the starches and sugars are found to vary considerably in quantity, from about 6 per cent. in turnips to 20 per cent. in sugar beets.

The crude fibre is the woody or stringy part of a plant. This material also varies greatly in its percentage in different feeds. In fish-meal it is absent, in roots it is very low, while in hay and straw it becomes high. Oat straw contains 34 per cent., rye-grass 30 per cent., brown hay ensilage 23·5 per cent. This will show that even in the roughages or fodders it varies greatly. Among the grains, oats possess 10·3 per cent., barley 4·5 per cent., maize 2·2 per cent., and maize as silage 5·7 per cent.

The soluble carbohydrates, and to a degree the crude fibre (in the case of ruminants), are converted by the animal body into heat and energy. The amounts of these substances digested and absorbed, but not required for maintenance, &c. (surplus to the demands for heat and energy), are converted into fat and stored in the body for any future emergency. In the case of the dairy cow these substances are converted into milk-fat and sugar, although they have no direct influence on the yield or composition of the milk, what is not required for milk-production being converted into fat, just as with other animals.

In the case of the dairy cow the crude fibre has another important function—the addition of bulk to the food. The digestive system of the dairy cow and the sheep and goat is highly organized to cope with this type of food with a far greater efficiency than that of other farm stock. But the important point is the added bulk, which is specially suited to the digestive requirements of ruminant stock. Pigs, on the other hand, owing to their particular type of digestive system, and also the age at which they are fattened, must not be fed on such materials. Though beneficial to the cow and sheep, it would be disastrous if given in the same way to pigs. Chaff, for instance, is not suitable for pig-feeding, although it is quite suitable for horses, sheep, and cattle.

Fats.

Fats are present in all farm fodders and grains in varying quantities. Carrots possess 0·2 per cent., mangolds 0·1 per cent., pasture 0·8 per cent., barley 1·5 per cent., and oats 4·8 per cent. What frequently is described as the artificial or concentrated foods contain much more, but these foods are of interest to only a limited number of our farmers. The fats or oils may be described as a concentrated form of heat and energy so far as the animal is concerned. They provide two or three times as much heat as the same quantity of carbohydrate. Their function is similar to that of the carbohydrates; what is not required for immediate use is stored in various parts of the body after being converted into the fat peculiar to the animal which has digested it.

It has just been said that fats are changed or reconstituted in the animal body. At the same time it will be interesting to note their

effect on the butterfat of milk. Fats consumed by the animal do not cause the milk to become richer in butterfat percentage. They may cause a temporary change, but any alteration in diet will act similarly. Their main effect is on the character of the butterfat when made into butter. Some fats cause the butter to be much whiter, some harder, some softer, and some make it decidedly oily. But so long as farm produce or crops alone are used for feeding dairy stock little variation results other than in the colour and to a slight extent in the hardness of the butter.

Proteins.

These are what is popularly known as the flesh-forming part of a food; chemically they are extremely complex substances. As found in plants they are not all alike; they differ from each other just as they do in human food. Farm crops show great differences in their protein content. All the leguminous crops, such as lucerne, clover, peas, and beans, contain the highest, and the green forages (except young growing plants) the lowest. Carrots contain 1·2 per cent., mangolds 1·2 per cent., turnips 1·0 per cent., perennial rye-grass 2·9 per cent., brown hay silage 10·2 per cent., and separated milk 3·5 per cent.

Although the proteins are described as the flesh-formers they may be utilized by the body to produce heat and energy, but at a very great waste. It is not advisable, either from an economic or a health standpoint, to provide more of this type of food than the body requires. Proteins are expensive, and, further, they throw a great strain on the animal system to eliminate what is not required by the body. In many instances their excessive use has caused much trouble and even death among young pigs.

A good supply of protein is very essential for dairy cows in milk. It is necessary for milk - production, and, moreover, stimulates the animal to produce. At the same time it should be borne in mind that the animal must be given a variety of this substance by providing as great a mixture of foodstuffs or grasses as possible. Proteins differ according to their origin, and as it is not known definitely which of them may possibly be curtailed or even neglected it is advisable that as great a variety as possible should be fed. From an animal-nutrition point of view it is essential for all pastures to be composed of as many different grasses as practicable, and for these in turn to be in a healthy and vigorous condition. It must be borne in mind that just as an animal can suffer from malnutrition so can a plant. A grass weak and deficient in food value becomes in time manifest in the stock which eat it. It may not show for several generations, but it will surely do so in the end. If an animal has to live and thrive chiefly on pasture, the greater becomes the necessity for this source of food to be in as wholesome a condition as manuring and management can make it. A certain quantity is essential, but quality is just as essential. A dairy cow, for example, can exist for a considerable time on straw—an extreme case of feeding quantity with little quality. But give that same animal as much as she can consume of good nutritious hay and she will live and produce. Just as there is a difference between straw and hay, so do we find a difference between good, suitably-manured, well-managed pastures and those which receive only the minimum of attention.

Vitamins.

Vitamins are substances about which little will be said here other than that their existence is being investigated. The writer follows the belief that stock find their needs in good mixed pasture. He is also of the opinion that the so-called action of vitamins may some day be proved to be a mineral action, or rather the action of a combination of minerals. At any rate, knowledge of what they are, how they act physiologically, how much the animal system requires of each, their individual action on the body, whether they are stored in the body or not, and so forth, is still far too incomplete to be included here. At the same time it may be noted that specific nutritional peculiarities are observed with certain foodstuffs.

Chemists group those materials already described — namely, the carbohydrates, fats, and proteins—as the organic constituents of food, and the ash as the inorganic constituent. Although the ash is composed of a very great number of different compounds it forms a very small portion of the food, but a very necessary portion. The more the mineral requirements of live-stock are studied the more complex does the subject become. The requirements vary according to age, breed, and (strange as it may sound) the quantity of food consumed by the animal. These are only a few of the factors which influence mineral requirements; to that list could be added type of food.

The ash constituents are utilized in the young growing animal body especially for the building-up of the frame, and in the older body for its repair, the development of the fœtus, and in milking animals for all the milk solids. So long as the young animal is being suckled nature provides it with a plentiful supply of minerals in the mother's milk. But how much of these minerals can be assimilated by the young or even the mature animal when added to their food is not yet known.

The most important constituents of the ash from the feeding viewpoint are calcium, phosphorus, sodium, chlorine, and iodine. Iodine, although occurring in comparatively small quantities, is very important; its presence co-ordinates the processes of assimilation, resulting in increased growth. The values of sodium and chlorine are well known by the result of feeding ordinary salt.

Calcium in feeds is generally referred to as lime. It is very unevenly distributed. Bran contains 0·2 per cent., and oats and beans 0·1 per cent.; so it is seen that in these types of feeds lime is relatively low. Pasture grass and oat silage contain 0·4 per cent., mangolds 0·05 per cent., and meadow hay 1 per cent. It needs no further examples to show how the general farm crop is very poor relatively in its lime content.

As for the phosphorus, which is generally expressed as phosphoric acid, it is more evenly distributed. Oat silage has 0·25 per cent., pasture grass 0·15 per cent., mangolds 0·1 per cent., and hay 0·4 per cent.

Where production is the object (and it should always be so) a deficiency in the ash of the food given means that the animal must draw on its own stores. This will last for a period, but will ultimately

lead to reduced production and even disease. From what has been said it will readily be understood why the dairy cow should be well fed during her dry period. This is the farmer's opportunity to enable her to lay up a reserve store of minerals to fall back on during the height of her lactation especially. Failure to do this — to feed well during the dry period — can only result in decreased output. It should also be obvious that the practice of turning dairy cows out on a turnip crop and allowing them to feed there with little or no good clover hay to supplement the roots only means future failure to achieve the maximum from the herd.

The foregoing remarks apply equally to the pig. No doubt the shorter life of the pig does not afford the same opportunity for observing any deficiency, but how great must it be when rickets occur in this animal. Rickets are only a symptom of the deficiency which has occurred—lack of minerals or ash in the diet.

(To be continued.)

PRESERVING FENCE-POSTS WITH CREOSOTE.

In the *Journal* for April, 1925, was published an article by Mr. A. J. Entrican, State Forest Service, dealing with the preservative treatment of fencing-posts. Since that date the Service has slightly revised its practice in some particulars according to later experience. In the creosoting of posts by the open-tank process the following time-schedule of immersion for the various species is now recommended :—

Species.	Butt.		Top.	
	Hot Bath.	Cold Bath.	Hot Bath.	Cold Bath.
	Hours.	Hours.	Hours.	Hours.
Pinus austriaca (Austrian pine), *P. densiflora* (red-pine of Japan), *P. Murrayana* (Murray's pine), *P. rigida* (pitch-pine), *P. strobus* (white-pine)	1	½	Nil	1
Pinus Laricio (Corsican pine), *P. muricata* (prickly-cone pine), *P. ponderosa* (pondosa pine), *P. radiata* (insignis pine), *P. taeda* (loblolly pine), *P. teocote* (twisted-leaf pine)	1	Nil	Nil	1
Eucalypts (all species)	3	1½	1½	1
Poplar and willows	3	2	1½	1
White-birch (*Betula alba*)	2½	1	1½	½
Wattle	5	2½	2	1
Hinau, matai, tawa, tawhero, kamahi, rewarewa	4	2	2	1
Tawari, red-beech	5	2	2	1
Mountain-beech, silver-beech	8	4	3	1

The treatment recommended for the second group of pines is for thoroughly seasoned timber. If any doubt as to seasoning exists they should be given a longer treatment—at least as long as that recommended for the first group of pines.

Other information on the subject is given in a concise form in State Forest Service Leaflet No. 5, from which the table is extracted.

NORTHERN WAIROA EXPERIMENTAL AND DEMONSTRATION FARM.

ESTABLISHMENT AND FIRST TWO YEARS' WORKING.

C. J. HAMBLYN, B.Ag., Instructor in Agriculture, Whangarei.

ESTABLISHMENT OF THE FARM.

FROM the commencement of operations at the Stratford Demonstration Farm in 1917 keen interest was taken in that institution and its working by many of the progressive farmers of the Northern Wairoa district, and at the first winter farm-school held at Dargaville in 1924 the possibility of establishing a local farm to be run on similar lines was discussed with officers of the Department of Agriculture. This led to the setting-up of a committee early in 1925, representative of the farming and business interests of the district, to go fully into the question of acquiring a suitable property. It was desired that the farm should be easily accessible to farmers visiting Dargaville, and that at least two soil-types—river-flats and sandy gum-land—should be represented. River-flats comprise some 20,000 acres along both sides of the Northern Wairoa River, and the sandy gum-land occupies an extensive belt of country between the river and the west coast, as well as isolated areas eastward of the river.

After a careful inspection of several properties offered, the committee decided that the most suitable one in respect of the two features mentioned was a farm of 125 acres at Mangatara, one and a half miles from Dargaville, a portion of the estate of the late Donald Finlayson. The farm comprised 26 acres of the sandy gum-land in weak paspalum, brown-top, and danthonia pasture sown about four years, and 99 acres of river-flat made up of 44 acres in fair rye-grass-cocksfoot pasture, 12 acres in new grass, 9 acres in young paspalum and clovers sown with a crop of millet, 6 acres in cultivation, and the balance of 28 acres (within the borough boundary) in rough-sown swamp. The farm was subdivided into twelve paddocks of various sizes, most of the fences being in bad repair. The main buildings consisted of a good six-roomed kauri house, and an eight-bail walk-through cow-shed with milking-machine and plant complete. The terms offered the committee were a lease of the property for three years at 6 per cent. on the purchase price of £45 per acre, with the right of purchase. Borough and county rates, including rates for borough water laid on, amounted to £90.

On the recommendation of the committee the terms were agreed to, the society known as the Northern Wairoa Experimental and Demonstration Farm Society was formed and duly incorporated, and an executive committee of farmers and business men elected. The rules adopted were practically the same as those of the Stratford Demonstration Farm.

The society commenced with a membership of 134. An application for a Government subsidy of £300 per year for three years was applied for and granted, a loan was raised for the purchase of stock and implements, and a manager was appointed. Farm operations commenced on 1st July, 1925.

First Year's Operations: Season 1925-26.

From the time the property was inspected in March until the Farm Society finally took it over at the beginning of July a great deal of damage was done to the permanent pastures on the flats, first by an invasion of black crickets, which destroyed most of the rye-grass and cocksfoot over large areas of the best paddocks, and later by the heavy stocking of the pastures while they were waterlogged, immediately prior to the clearing sale held by the previous owner at the end of June. As a result one pasture of 12 acres reverted rapidly to a dense growth of rushes, and two young pastures of 12 acres were tramped under and replaced by pennyroyal and buttercup, thus reducing the available grazing by at least half.

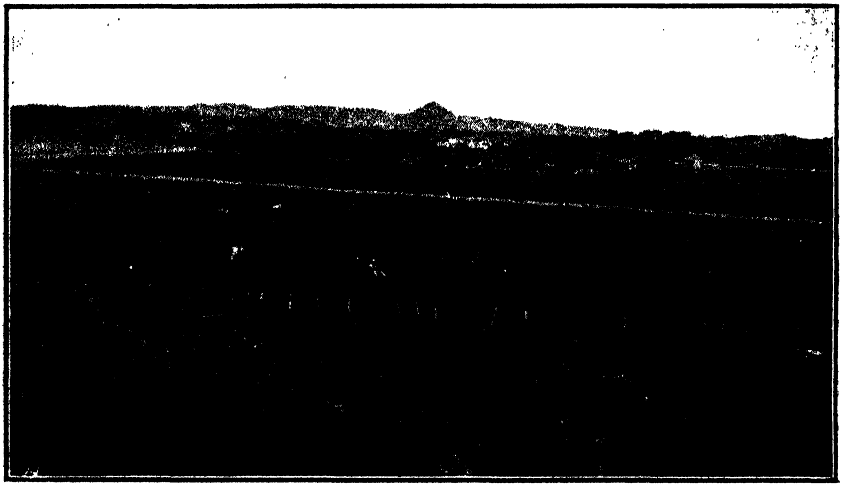

FIG. 1. VIEW OVER RIVER-FLAT PORTION OF FARM, SHOWING NEW OPEN DRAINAGE SYSTEM.

THE DAIRY HERD.

It had been originally intended to carry between forty-five and fifty cows, but the number was finally reduced to thirty-two cows and six heifers, purchased at clearing sales. It was recognized that with the drainage conditions then existing on the farm (which the society was not in a position to alter immediately) and with successful supplementary cropping dependent on weather conditions in the spring and early summer any attempt to carry more stock than the number just mentioned would be unsafe. The herd purchased consisted of good average cross-bred animals from tested herds, it being the intention to grade up as rapidly as possible by the use of pedigree Jersey bulls with the requisite butterfat backing.

SUPPLEMENTARY CROPPING.

A system of supplementary cropping was undertaken to supply additional feed from January onwards, and for that purpose 12 acres was sown in various crops as described below. Attempts to increase

the pasture area, so as to provide for hay, by disking and surface-sowing a portion of the area tramped out were not successful, due to the sodden condition of the ground until late October, followed by a sudden drying out in November.

An area of 2 acres of College Algerian oats was sown in the third week in October with 6 lb. of red clover, and fed out in January, after which the red clover provided excellent feeding for another two months. Three acres of green maize was sown in breaks of 1 acre, the first being Ninety-day, followed by two of Hickory King. The inclusion of 1 bushel of partridge peas with the last break considerably improved the feeding-value, the peas coming away well among the maize, which was sown in 14 in. rows, while the peas were cross-drilled through every coulter.

FIG. 2. DEMONSTRATION WITH THE MOLE PLOUGH, TRACTOR-DRAWN.

The gum-land portion of farm lies on terrace in background. Manager's house seen on rise.

The maize lasted until the end of April, when the feeding of 2 acres of chou moellier was started. The chou moellier had to be resown, and it was interesting to note that the first sowing at the beginning of December escaped almost entirely an attack of diamond-back moth grubs and also aphis, while that sown a month later was able to make little headway on account of these pests until the first autumn rains at the beginning of April. Two acres was sown in mangolds, but with the exception of a few rows transplanted in early December the results were poor. The crop was badly attacked in the seedling stage by cut-worms, and owing to the bad drainage conditions the ground could not be sufficiently well prepared for this crop.

Several manurial and variety trials were set at the request of the committee, but the results, as expected, were completely obscured by the unsuitable conditions for the growth of the crops. As already indicated, until the soil conditions are improved by an effective drainage system the successful growing of annual crops on such

land is dependent almost entirely on the weather conditions. The crops grown, however, were sufficient for the purpose, with the exception of the failure of the hay crop and the partial failure of the mangolds, which necessitated the removal of the majority of the stock from the farm for the winter.

PASTURE-IMPROVEMENT.

The top-dressing of 36 acres of pasture was carried out in July and August, and the effect of this treatment was apparent throughout the season. Considerable areas of pennyroyal and buttercup gave way to the improved growth of rye-grass and white clover. The policy with regard to top-dressing on the farm, in order to avoid confusion later, has been to top-dress the whole of each paddock with a straight phosphatic manure. During the first season basic slag and superphosphate were used at the rate of 3 cwt. per acre on separate paddocks, and one paddock of 9 acres received 3 cwt. per acre of Ephos phosphate, following the sowing-down in the previous year of the area with this manure. Until such time as definite trials can be carried out much useful information may be gathered from observation of the growth in the various paddocks, and especially the effect on the cows of a change from one paddock to another.

The general scheme as regards the pastures on the farm, which will be followed as far as possible, is as follows: Firstly, a rapid increase in the proportion of pasture to land under crops, with finally the elimination of all crops, excepting perhaps mangolds and carrots; the top-dressing of the best pastures first, extending the treatment as funds permit to all the permanent grassland; then increasing the amount of top-dressing on the best pastures by two and even three applications each year, together with further subdivision and consequent increased stocking.

Before very much can be done along these lines a considerable improvement must be effected in the drainage of the farm, and with this in view plans and specifications of a main drainage scheme as a basis for future work were drawn up for the society by the Lands and Survey Department. A commencement was made with this work early in the present season.

A further 6 acres of permanent pasture was sown in the autumn of 1926, and preparations were made for the treatment of the 12 acres which had reverted to rushes, with a view to eventually putting it into pasture also.

BUTTERFAT PRODUCTION AND FARM FINANCE.

During the season the original herd of thirty-eight cows and heifers was reduced by various losses to thirty-three. The average factory return of butterfat per cow was 210 lb., a marked reduction on the total butterfat production of the farm for the previous year, which according to the factory returns was 210 lb. per cow from forty-five cows.

As was expected when the farm was taken over, the balance-sheet showed a deficit, this amounting to £287 on the year's working. The prospects of improving the position not being encouraging, negotiations were opened with the trustees of the estate, with the result that the property was finally placed on offer to the society at a cash purchase

price of £32 per acre, with a considerable rebate of outstanding rent still due. At the first annual general meeting of the society held in July, 1926, the position was reviewed, with the result that the newly elected executive committee was instructed to complete negotiations for the purchase and arrange for the necessary finance.

Second Year's Operations: Season 1926-27.

Early in the season negotiations were completed for the purchase of the farm by the society, the change-over from leasehold to freehold being made on 1st December, 1926. At the same time arrangements were made to borrow up to £300 to carry out necessary improvements, chiefly in the way of drainage. Briefly, the position with regard to the farm as it now stands is that the land and buildings are subject to two mortgages, one of £3,000 bearing interest at 6½ per cent., including a sinking fund of 1 per cent., and a second mortgage of £1,000 at 5 per cent. and falling due on 31st December, 1928. In addition, interest has to be paid on the loan as it is lifted for improvements, and the stock and implements are mortgaged to the extent of £500 at 9 per cent.

Owing to the general financial stringency which existed during the past year the society postponed the appeal for funds to assist in wiping out the second mortgage and the chattel mortgage, but there is every indication that the required amount will be raised in the district, so that the farm and stock will virtually belong to the farmers of the Northern Wairoa.

PASTURES.

The work of improving and renewing the permanent pastures was continued during the year. Sixty acres was top-dressed at the rate of 3 cwt. of fertilizer per acre, 4½ tons of superphosphate, 3 tons of basic slag, and 1½ tons of Ephos phosphate being used for this purpose. The policy of top-dressing each paddock with a single fertilizer was continued. So far as can be judged by a careful study of the pasture and the preference shown by the stock basic slag is giving the best results. The effect of the slag is more marked in spring and autumn, when there is plenty of moisture in the soil, whereas the superphosphate tends to show up to advantage during dry weather in February and March. The next advance in the top-dressing will be the alternation of slag with super as the annual top-dressing, followed by double top-dressing with slag in autumn and super in late spring. The effects of the top-dressing have been marked throughout by a rapid improvement in the sward and the crowding-out of pennyroyal and buttercup.

A further area of 6 acres was sown to permanent pasture; an additional 9 acres, in which there was a fair amount of paspalum but which had reverted to a dense growth of rushes, was broken up and cropped with maize preliminary to laying down to permanent grass in the spring after disking.

Altogether the area in pasture has been increased from some 36 acres in the first season to 67 acres, which is available during the current season.

CROPS.

Though it was the original intention to reduce the area under crop the method adopted in dealing with the excessive growth of rushes

on the paddock already mentioned necessitated ploughing and cropping for one season. In order to allow free seeding of the scattered paspalum a crop of cob maize was taken off this paddock, while another 6 acres was used for growing supplementary feed for the herd, and 3 acres for pigs.

The crops for the herd included 2 acres of chou moellier and 2 acres of swedes for late autumn and winter feed, and 3 acres of soft turnips, which were fed out from the end of January until the end of April. In addition, an extra 2 acres of swedes was sown on a portion of the rush-paddock which could not be prepared in time for the maize. This crop, though only sown on 14th January after a rough preparation, did well and lasted well into the spring despite wet winter conditions.

FIG. 3. CHOU MOELLIER CROP FOUR AND A HALF MONTHS AFTER SOWING.

Six acres of cob maize was grown, the variety being Early Butler, which matured well despite late sowing and an exceptionally early frost at the end of April. The crops grown for the pigs included artichokes, partridge peas, and a portion of the soft turnips.

Though no manurial trials and few variety trials were carried out the crops grown were of particular interest to visiting farmers, especially as regards the improvement shown on those of the previous season, mainly on account of the improved drainage conditions.

DRAINAGE.

Considerable permanent improvements were carried out on the farm during the year, chiefly in drainage. Though open drains to an estimated value of some £200 had been put in by the previous occupiers, the system was haphazard with no definite main outlet, and was altogether

unsatisfactory. The system, however, was similar to many farm-drainage schemes to be seen in the district. The construction of a sufficiently deep and adequate main outlet was carried out, together with a suitable flood-gate. A new system of 29½ chains of subsidiary drains was dug to connect up the existing open drains. The farm is thus provided with a good basis on which to plan future drainage operations. Already the effect of the more rapid removal of surface water and improved underground drainage is to be noted in pastures and crops, while the damage done to the land by stock in wet weather has not been nearly so great.

DAIRY HERD AND PIGS.

Owing to difficulty in getting many cows of the herd in calf, and losses from mammitis and other causes, only thirty-two cows were milked through the season. When it was realized that the cows would be exceptionally late in coming to profit it was decided to retain twenty yearling heifers reared on the farm, rather than purchase more stock late in the season. Another factor militating against good returns was the fact that the majority of the cows had been wintered off the farm and had fared badly. The herd-testing returns showed an average per cow of 244 lb. butterfat in 220 days, the short average milking-period being accounted for by the lateness of calving due to the difficulty experienced the previous summer. The total butterfat production showed an increase of only 100 lb. on that of the previous season. However, the herd finished up in excellent condition, and, with the heifers retained, a considerable improvement should be shown in the current season. The cows were wintered on the 26 acres of gum-land, where they were fed the swedes, chou moellier, and some 15 tons of meadow and oaten hay.

The returns from the pigs amounted to £120, this being almost three times the amount received from this section in the previous year. In addition a considerable increase in the number of pigs carried over was made.

FINANCIAL AND GENERAL.

The balance-sheet for the year showed a net profit from Profit and Loss Account of £105, a decided improvement on the position at the end of the first year. The Farm Working Account is still far from satisfactory, but with the improved conditions and a herd of forty-five cows being milked this season the position should rapidly improve. So soon as the initial financial difficulties of the society are overcome more definite experimental and demonstration work can be carried out. The membership of the society is steadily increasing, and at time of writing is approaching two hundred.

Several well-attended field days were held on the farm during the year and the number of visitors is rapidly increasing.

Lemon-growing.—A steady increase is taking place in the area planted with citrus trees in New Zealand, particularly lemons, and satisfactory crops of good-quality fruit are being obtained. In the Tauranga district, which is well adapted for citrus-culture, it is estimated there are approximately 160 acres planted in lemon-orchards.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

ESMOND ATKINSON, Biological Laboratory, Wellington.

PIGWEED (*AMARANTHUS RETROFLEXUS*) AND LADY'S THUMB (*POLYGONUM PERSICARIA*).

CERTAIN plants have been illustrated and described from time to time in this series for the reason that they were newcomers, with their potentialities as weeds here little known. It is plainly desirable that in the case of a plant rapidly spreading through the country as many people as possible should be able to recognize it when they see it. Other articles have dealt with plants noted for their poisonous properties. Attention is now drawn to another class, consisting of that great army of common weeds of every type of country, among which experience shows that much confusion still exists. Some plants not resembling each other particularly closely have similar or identical popular names; others may be superficially alike but occupy quite different positions economically.

It is intended to use many of the drawings of this series hitherto published and all of those appearing from now onwards as contributions to a complete set illustrating the whole of the weeds found in New Zealand. It seems to the writer that a verbal description of a plant is as a rule either too technical to be of much use to any one but a botanist, or else too vague to convey at all a definite idea of its appearance. What is being aimed at, therefore, is to make the illustrations the final court of appeal, only such facts as colour, scent, variation in size, &c., being described in words.

The drawings here presented illustrate two common weeds about which inquiries are often received at this Laboratory.

Pigweed.

This plant, which is an annual of tropical American origin, is now widely distributed as a weed of waste places and of arable land in the warmer parts of New Zealand. It is commonest north of Auckland, and that is where it is most conspicuous as a weed, but it has been found in parts of the South Island, particularly in the Nelson District, and has been reported from Timaru northwards. It belongs to a small family which is more closely allied to the beets and fathens than to any other.

Fig. 1 shows the general appearance of the plant—natural size—and at (*b*) one of its most characteristic features is drawn in outline. This is the long, red, rather fleshy tap-root, which is the name given to roots descending straight down into the soil without branching much. It is this root that gives pigweed its other popular names of redroot and redshank. The stem is rather thick, green, 1 ft. to 3 ft. high, and branching to a certain extent, though small plants bearing ripe seeds may often be seen with only a single stem—upright and unbranched. The flowers are greenish, very small individually, but in a finger-shaped spike sometimes several inches long. There is a

FIG. 1. PIGWEED (AMARANTHUS RETROFLEXUS).

(*a*) Flowering shoot ; (*b*) root in outline ; (*c*) and (*d*) seeds. **(All natural size except (*d*).)**

[*Drawing by Esmond Atkinson.*

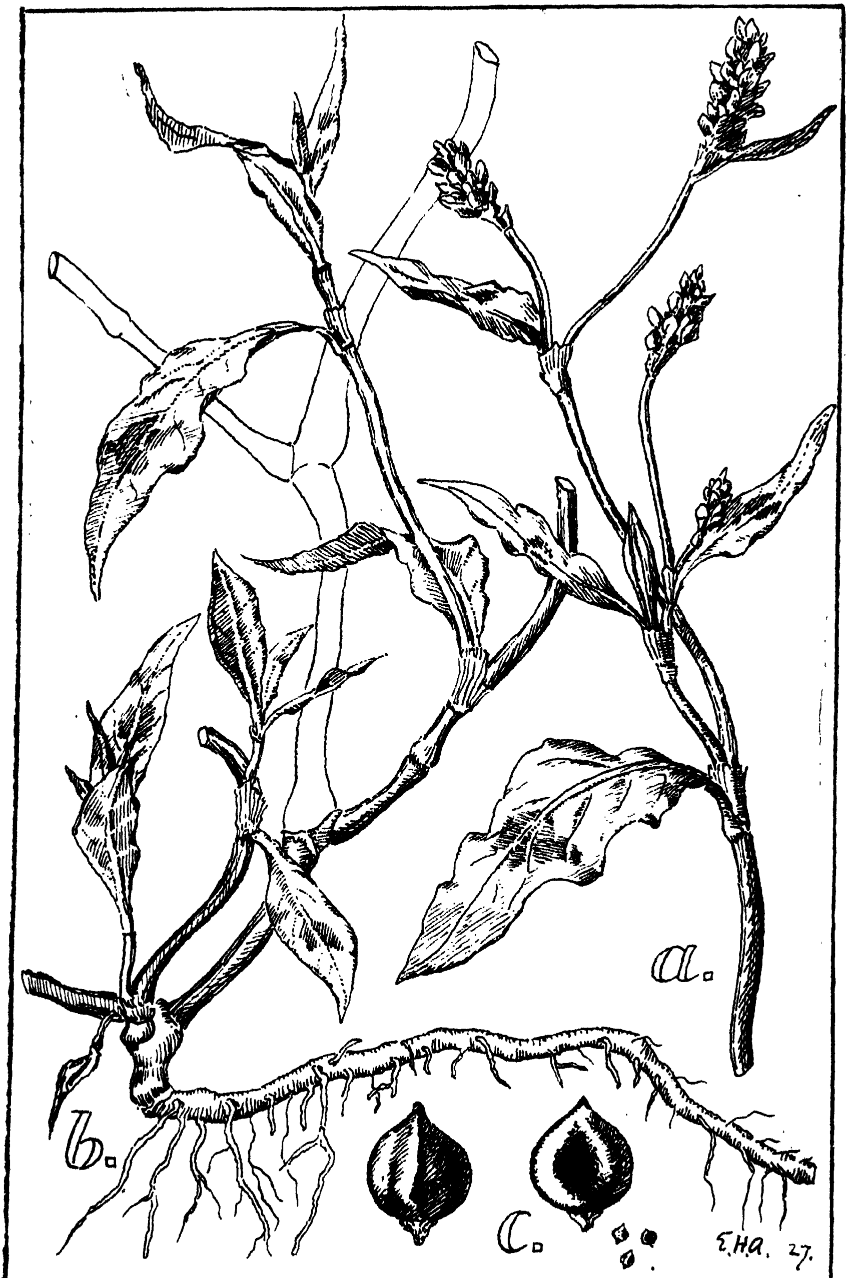

FIG. 2. LADY'S THUMB (POLYGONUM PERSICARIA).

(*a*) Flowering shoot; (*b*) lower stem and root; (*c*) seeds. (All natural size except two enlarged seeds.)

[*Drawing by Esmond Atkinson.*

single seed in each flower, the seed being very small (*c*), more or less lens-shaped (see (*d*), which shows the seeds from the front and side enlarged), brilliantly shining, and black or brown in colour. As the flowers do not fade in the way that those with conspicuous petals do, little change is visible from the bud onwards, so that many plants apparently in their early stages will be found to be full of ripe seeds.

Generally speaking, proper cultivation will check the spread of pigweed, the thing to aim at being to get rid of it on the first appearance of the flower-spikes. This is the safest way to make sure that no seeds fall to the ground, where they have the power of remaining dormant for many years. They are often found as impurities in various commercial lines of seeds, especially clovers.

Lady's Thumb.

Lady's thumb is a European annual now widely distributed, belonging to the family which includes the docks, sorrels, rhubarb, and buckwheat. There are a number of popular names besides the one used here—*e.g.*, persicaria, smartweed, and knotweed—while it shares with pigweed the name redshank.

The plant varies in appearance from a compact one a few inches high (when it is in the open by itself) to one with straggling stems several feet long (when it is growing among other plants). The drawing shows the shape of the stems with their swollen joints which give it the name "knotweed," while "redshank" describes their colour, which is red or purplish-red, varying in depth with the amount of light that falls on them. The leaves generally have a dark but dim irregular blotch (Fig. 2, *a* and *b*), and this distinguishes the weed from other common ones. The clusters of small flowers are pink, and the shining black seeds are of two distinct shapes—flattened, or triangular in section like a dock-seed (*c*).

Lady's thumb, which is common throughout both Islands, is a weed of damp cultivated ground, and needs a fair amount of moisture for its full development. It is then often very troublesome, particularly in pastures and also in grain crops, where, owing to its growing faster than the cereal, it chokes out the young plants. Thorough cultivation—in time to prevent the formation of seed—is necessary to hold this weed in check. The seeds occur as impurities in American samples of clover.

Arthritis in Lambs.—"An investigation into the cause of this condition was undertaken during the past season," states the Officer in Charge, Wallaceville Veterinary Laboratory, in his annual report for 1926–27, "and specimens were received from four meat-works. An organism has been isolated from these with such frequency and uniformity as to strongly suggest that it is the cause of the arthritis, and this is further borne out by the fact that arthritis can be caused in lambs by injecting this organism into the circulation. It now remains to discover how the organism gains entrance to the body, before means can be taken to prevent its occurrence, and this will involve field observations rather than laboratory work."

PACKING HONEY FOR EXPORT.

POINTS FOR BEEKEEPERS.

T. S. WINTER, Apiary Instructor and Honey Grader, Hamilton.

IN general the quality of the honey shipped during last export season was good, but there was much room for improvement in the condition of approximately one-half of the produce submitted. That is to say, the honey had an excellent flavour and was light in colour, but the general condition could have been improved considerably in a great many cases.

The amount of honey rejected for export each season is still far too great. The reasons for rejection are mainly the following faults: Soft granulation, liquid condition, two grades of honey under one extraction mark, fermentation, low specific gravity, and rusty containers.

SCUM AND FROTH.

The majority of producers lose points each exporting season because their honey is covered thickly with scum and froth. The cause of froth is aeration caused by excessive straining, and this applies more particularly to light honeys of good texture. The presence of scum (foreign matter) on the top of honey when packed is due to tinning too soon after extracting. On many occasions a few packages have been responsible for the deduction of points for scum and froth over the whole line. These packages comprised the top portion of the honey in the tanks before tinning, and were consequently filled last. Where producers are pushed for room, and are obliged to tin quickly, they should place the last few cases from any one tank under a separate extraction mark. For instance, if the line is marked "A," the last three cases should be marked "A2," and so on.

There is a method by which scum and froth can be eliminated altogether at all times and from all extracted honeys, but it calls for extreme care and extra storage room. The honey should be run while liquid into deep, narrow, storage tanks, and allowed to remain until granulation has commenced. It can then be slowly run off into 2 lb. or 60 lb. tins, and will granulate firm, showing no sign of scum or froth. Great care should be taken that the tanks (immediately the honey has cooled) are sealed tightly to exclude all air. The tanks should be filled to the top, and once tinning has commenced it should proceed until the tank is empty.

COARSE GRAIN.

Coarse grain has been the cause of loss to most beekeepers. All honey must be granulated firm before it is passed for export, and the nature of the granulation is taken into consideration by buyers. It cannot be said that honey with a very coarse grain is suitable for table use. In fact, all coarse-grained honey has to be reconditioned before it can be used at all for any purpose; consequently this class realizes comparatively poor prices.

In many parts of the Dominion during the early part of the season the bees work all available sources, thus storing a low-quality honey,

which for some reason takes a long time to granulate and is coarse. This is also the case with honey gathered late in the season. Beech honey is always coarse, and cannot be made first-class, no matter in what condition it is packed, owing to its objectionable flavour.

If the proper method is followed granulation can be controlled, and very coarse-grained honey can be reconditioned in a few days. At extracting-time a small quantity of smooth-grained honey should be placed into each tank of liquid honey, and the whole gently agitated until thoroughly mixed. The whole can then be tinned and sealed. Great care should be taken not to stir too much, or too quickly, otherwise air will be driven into the body of the honey and much trouble will result. The smooth granulated honey is broken up by kneading, and then gently stirred in. The operation should commence immediately the liquid honey has cleared itself of all impurities and the latter have been carefully removed from the surface. The proportion of smooth-grained honey should be not less than one in thirty for freshly extracted honey, or one in twenty for honey that is to be reconditioned. The best honey that any one beekeeper produces may not be good enough. Nothing but the best-conditioned honey, of very fine grain and light amber or white in colour, is suitable for this work.

RUSTY CONTAINERS.

Many lines were noticed in which the tins had not been oiled or lacquered. The owners were extremely fortunate that the packages had had a dry journey to the grading-stores. If the simple method of oiling tins on the outside with boiled linseed-oil before use was followed much after trouble and expense would be avoided.

TWO GRADES IN ONE CASE.

A mistake often made is that of placing two grades of honey in one case. It is impossible to issue a certificate covering such packages without placing the grader, seller, and buyer in a false position. Where there is a distinct difference between the honeys it is wrong to issue a certificate on either the higher or the lower grade. Therefore there is no alternative for the grader but to reject such lines for export when they are submitted. There is, of course, the possibility of a producer having one odd tin each of two grades on his hands, in which case the tins should be packed in cases cut to size and placed with the original lines.

EXTRACTION MARKS.

Extraction marks are often the cause of much trouble at the grading-stores. Some packers use a pencil, others paint marks on the cases, while some place written cards on the lids. The latter are apt to be rubbed off in transit to the stores. It is not always possible to distinguish pencil or paint marks, consequently the grader is put to much extra work and unnecessary trouble. It would facilitate the work, and prevent mistakes being made at the store, if all producers would use a set of 1 in. stencils for this work; the marks to be placed on the right or left top corner of each case. Producers should remember that any work undertaken at the grading - stores which should have been attended to by themselves is a direct charge on those concerned.

INFERIOR HONEYS.

Honeys gathered from ragwort, kiekie, and the beech-tree (" birch ") are objectionable in flavour and aroma, and cannot be classed as table honeys. It is a question whether they should not be specially branded before leaving the country. The principal localities in which these honeys are produced in quantity are as follows: Ragwort—King-country and Southland; beech—Westland and Southland; kiekie—Taranaki.

Ragwort is very common in Southland, and many honey outputs are spoilt by its inclusion with the main crop. This can be avoided if beekeepers will work systematically each season in regard to extracting. All colonies should be extracted clean where possible before the ragwort yields, and all subsequent extractions should be specially marked to avoid mixing at the grading-store. The main crop throughout Southland is white in colour. Ragwort honey is light amber; therefore in the event of a beekeeper not being able to extract clean before the ragwort yields it should be an easy matter for him to separate the combs at extracting-time. Better returns will be obtained if this course is followed.

POINTS FOR BEEKEEPERS.

There are many ways by which beekeepers can safeguard their honey against deterioration. Many tons are spoilt each year simply because packers are not careful enough at extracting-time. The following points (largely summarizing the foregoing notes) are given in conclusion:—

(1) Never expose honey to a damp atmosphere.

(2) Cover all tanks to exclude moisture or dust.

(3) Use only clean, dry appliances.

(4) Do not allow honey to run long distances from one tank to another along shallow, open channels.

(5) Use only deep, narrow tanks, circular for preference.

(6) Do not tin honey until it has properly cooled, otherwise trouble may be experienced with granulation.

(7) Do not run warm freshly-extracted honey into a tank containing cold liquid honey.

(8) Endeavour always to keep separate each extraction, and mark cases accordingly with 1 in. stencils.

(9) Remember that excessive straining causes aeration and ultimately much froth on the surface of the honey.

(10) Never store wet extracted combs from one season to another in the honey-packing room, or there will be trouble with fermentation. A shed or room apart from the honey-house should be provided if necessary.

Imported Fruit, Plants, &c.—The annual report of the Horticulture Division for 1926–27 states that most consignments arrived clean and free from disease. One or two lines were condemned and destroyed on account of fruit-fly infection, and a quantity of almonds and walnuts had to be similarly dealt with for Indian meal-moth. Fumigation was found necessary in connection with a few consignments found to be affected with live scale. Importations by parcel-post increased. With very few exceptions bulbs were of good quality, and bulb-mite was considerably less conspicuous.

NEW ZEALAND CHEMICAL RESEARCH.

SOME RECENT REFERENCES ABROAD.

1. Deficiency Diseases of Stock.

ONE of the papers circulated at the recent Imperial Agricultural Conference, London, by the organizing committee dealt with iron starvation (bush sickness). The special interest of the subject to New Zealand readers and the conciseness with which the matter is stated warrant quotation of the paper in full, as follows :—

Iron starvation or bush sickness is a deficiency disease, proved to be non-transmissible, and one that does not spread, occurring in ruminant stock only when pastured on land extending over a wide area in the central volcanic plateau of the North Island of New Zealand and the adjacent country. Some millions of acres are more or less affected, the soil being formed from rhyolitic pumice deposited from air, not water as is usually the case in the formation of soils.

In 1904 an analysis by Aston of the blood of an animal in an advanced stage of the disease showed that there was a great deficiency of iron, which led him to suggest the trial of ferrous sulphate as a top-dressing for pasture upon which sheep were grazed in an experimental paddock. When the results were obtained it led him to suggest that a deficiency of iron in the pasture (the animals' sole ration) was the cause of the disease. After some twenty years' laboratory and field work it is considered fully proved that bush sickness is really iron starvation. Animals in an advanced stage of the disease are fully restored to health on the same feed as that upon which they became affected if dosed with phosphate of iron in the form of Syr. Ferri. Phos. Co. B.P., or with the double citrate of iron and ammonium. If the animal is not so dosed it invariably dies, and if dosed it just as invariably recovers, all the symptoms being those of nutritional anæmia.

It is important to remember that if steps are not taken to prevent the disease in a herd the mortality will be 100 per cent., whereas a non-ruminant—*e.g.*, horses—may continue healthy for many years on the same food and water on which a cow will sicken and die in from six to nine months.

The pasture is composed chiefly of red and white clovers and cocksfoot. Animals taken away for a change to healthy country, and then brought back still in poor store condition, may now be fattened on the pasture upon which they originally became sick. The bones of an animal dead of bush sickness show no signs of malnutrition. These facts indicate that the disease cannot be referred to chronic poisoning, and that a deficiency of some essential element in the food is the real cause.

The abundance of clovers, and the excellence of the diseased animals' bones, preclude the thought that the bone-forming elements, calcium and phosphorus, are deficient in the pasture. Feeding tests have eliminated all other essential elements except iron, which is found to be abnormally low in the affected soils and in the pasture grown upon them.

In "Agricultural Research in the British Empire,"* recently issued from the Reid Library, Rowett Research Institute, Aberdeen, in which work in the different overseas portions of the Empire is treated under geographical headings, five pages are devoted to agricultural research in New Zealand, from which the following extracts are made :—

Malnutrition in Stock.—Though New Zealand is in many ways such an excellent stock country, deficiency diseases occur in some districts. A disease in the bones was noticed some time ago amongst sheep which had moved from one pasture to another. They ceased to thrive, and when made to walk they were seen to be lame. Fractures of the bones were frequent. Post-mortem

* By various authors. A preface by Major Walter Elliot, Parliamentary Under-Secretary of State for Scotland, and an introduction by Dr. J. B. Orr, Director of the Rowett Research Institute, are sufficient guarantee of the care taken in selecting the material for publication. The section on New Zealand is compiled by J. S. Thomson and Dr. Orr.

examination showed that in well-marked cases the bones had become thin and shell-like. An investigation into the cause of this condition revealed the fact that the land on which this condition occurred was deficient in lime and phosphorus. The appropriate measures have been taken to prevent this disease in sheep. It is still, however, prevalent among cattle, especially in heavy-milking cows. These are treated by the administration of substances deficient in the pastures, but there is urgent need for further work in determining the nature of the deficiencies in the various pastures and fodder plants.

A specially interesting case of deficiency disease, known as "bush sickness," occurs in a district in the North Island. The researches of Aston, head of the Chemical Division, have established the nature of this disease, and—what is more important—a successful method of treatment. The chief symptoms are extreme anæmia and emaciation. The administration of iron salts leads to a cure.

Economic Importance of Research.—In view of the attempts being made at the present time to secure co-operation in research within the Empire, it is of special interest to note that all the main lines of research being carried out in New Zealand have a direct bearing on problems in other parts of the Empire. Thus the problems on mineral deficiencies in the pasture are of the same nature as those to which reference has been made in the two previous articles as occurring in South Africa and Canada, and the work on these problems in New Zealand is throwing light upon similar problems elsewhere. Aston's work on "bush sickness" has proved of value in connection with a somewhat similar disease occurring in limited areas in Kenya Colony and in the south of Scotland. In the same way the work on "biological control" of injurious insects and noxious weeds is of general Empire interest. Indeed, some of the work referred to above has already been applied successfully in Australia.

In recognition of the value to the whole Empire of the work in New Zealand on deficiencies in the soils and pastures, a special grant has been made by the Empire Marketing Board Research Committee for an extension of the work now proceeding on the mineral content of pastures. This extended work is to be carried out as part of a general scheme which connects up the work on mineral metabolism at the Rowett Institute, phosphorus deficiency in South Africa, mineral deficiencies in pastures in East Africa—and, indeed, all the important work of this nature throughout the Empire.

An article by C. G. Dickinson, B.V.Sc., on "King Island Coasty Disease," published in the *Australian Veterinary Journal* for September, 1927, makes interesting comparisons between that disease and bush sickness as occurring in New Zealand, and the following extracts are here reprinted :—

The disease known as "coastiness" on King Island was first seen by the writer in April, 1924, and a comparison of the symptoms of this disease with descriptions of the "bush sickness" of New Zealand (which occurs on the pumice lands of the Rotorua district), coupled with analyses of "coasty" soils, led to the belief that the two diseases were similar, if not identical. This belief was strengthened by interchange of correspondence with Mr. B. C. Aston, Chemist of the New Zealand Department of Agriculture, who has for years been investigating the New Zealand disease.

The great difference in iron content in the two classes of soils, coupled with the symptoms of anæmia displayed by animals grazed on "coasty" soils, and the fact that such animals recover when grazed on "sound" soil, points to the trouble being primarily an iron starvation, though it is probable that other factors may operate to a greater or lesser extent. It is known chemically that the presence of alkaline earth carbonates renders iron less soluble, so that it is probable that the high percentage of lime carbonate in "coasty" soil also operates by rendering the iron content (1·413 per cent.) of that class of soil less available.

In the early New Zealand experiments attempts to transmit the disease from one animal to another by means of inoculation and blood-transfusion failed.

Points of similarity between the two diseases, "coastiness" on King Island and "bush sickness" in New Zealand, are as follows :—

(1) In both cases there are symptoms of progressive anæmia.

(2) In both cases diseased cattle are cured by grazing on "sound" country. (By "sound" country is meant country that would cure the disease: there is, on King Island, another type of country called "semi-sound," which will not cause "coastiness," but, on the other hand, it will not cure it either.)

(3) In both cases such cured cattle do not, though cured, improve in general condition until grazed again on "coasty" or "bush-sick" country.

(4) In both cases the soils of affected runs are of a loose, non-binding nature.

(5) In coastiness the disease is developed after about six months' grazing on coasty soil, whereas in New Zealand it takes a longer period (about twelve months). The New Zealand soil has not such a high percentage of lime carbonate, and it was found, in their initial experiments, that when the pasture was top-dressed with lime the disease was contracted much more quickly; in other words, the addition of lime to the New Zealand pastures made them more like King Island natural pastures, with the result that bush sickness was then contracted in about the same time that coastiness is naturally contracted—*videlicet*, in from four to six months.

Having established the close similarity between coastiness and bush sickness, it was decided to apply to King Island conditions the New Zealand preventive, which has been arrived at after years of experimentation. To this end a quantity of lick was made to the following formula: Ferri et ammon. citras 2 oz., brown sugar 4 lb. It is necessary to use the brown sugar as a base for the lick, so as to overcome the bitter taste of the iron salt.

Details of the experiments on calves are then given, which generally showed recovery in the case of six treated with the iron-ammonium citrate. Due acknowledgment is made of Mr. Aston's articles in the *New Zealand Journal of Agriculture.*

2. Wheat-testing.

Among the papers issued by the organizing committee of the Imperial Agricultural Research Conference was one on the testing of New Zealand wheats by the Chemistry Section of our Department of Agriculture, as follows:—

Milling tests of pure varieties of wheats obtained from four different harvests have now been made. Chemical analyses have been carried out on all the flours obtained, and baking tests in a considerable number of cases.

The average amount of flour obtained has been about 73 per cent. of the grain, which must be considered good. Different varieties of wheat have been found to yield different average percentages of flour. Localities, too, have been found to differ in this respect. Canterbury samples have so far averaged about 73 per cent. of flour.

Chemical analyses have shown that the protein content is a useful though variable indication of the baking-quality of the flours. The well-known local variety, Velvet, has yielded the best-quality flour of the more commonly grown wheats. Lesser-known varieties have been found to produce flour of very good quality.

The effect of environment on flour-quality has been noted. Some localities, and more particularly the Tuapeka and Upper Taieri (Central Otago) districts, have proved to be producers of wheat of excellent quality. Tuapeka and Upper Taieri are areas of fairly low rainfall and a good, hot, growing season. Local samples of good quality compare favourably with the best grown in the United States, Canada, and Australia.

A considerable amount of work has been done in attempting to correlate the quality of flours with their chemical composition. The colloidal state of glutens from different flours has been investigated, also the hydrogen ion concentration and the degree of buffering of certain flours. It is hoped that this work will eventually lead to some useful commercial application.

Concerning this work, Thomson and Orr ("Agricultural Research in the British Empire," p. 20) say: "The quality of wheat for bread-making is almost as important as the yield. The staff of the Chemistry Section has been investigating the baking-qualities of different strains in producing a good loaf, and certain important correlations between the chemical composition and the results of experimental baking have been discovered. Further work in breeding and selection is being done to obtain new strains which will combine heavy yields with good quality."

SEASONAL NOTES.

THE FARM.

BREAKING UP STUBBLES.

THE time and method of stubble cultivation depend on the type of rotational farming followed in a given locality. In the sub-humid arable farming districts, such as Canterbury, cereals either end the rotation when grass has been sown with them in the spring, or they are followed by root and forage crops or by grass. Catch-crops of green cereals to provide autumn feed are frequently taken between the cereal and root or forage crops. The earlier the green feed is got in the better, so that the first sowing usually follows early-harvested autumn-sown oats. Algerian oats or Cape barley are the cereals usually chosen for green feed—the latter being generally the most successful when the soil conditions are very dry. On light and medium land the green crop can be most cheaply established by broadcasting the seed on the stubble and covering with a one-way disk cultivator, or by skim-ploughing. The seed-bed for green cereals is also frequently prepared by ploughing and working down in the ordinary way prior to drilling the crop. Although this method entails more time than the previously mentioned one, the work put into the land for the green cereal lightens the cultivation work necessary in the following spring prior to sowing the land in root or forage crops.

On really heavy land it is often impossible to break up the stubbles until the land has been softened by the autumn rains, and much of the wheat stubble land cannot be ploughed till March or April. The teams are usually busy at this period preparing land for autumn and winter sown cereals, so that the stubbles on heavy land are usually left till July or August before they are broken up. Every endeavour should be made to get the land turned over as early as possible, so that it may get the benefit of a winter fallow. There are frequently periods in May and June when land can be ploughed, but the weather conditions are not suitable for cultivation work or for drilling, and it is during these periods that the heavy stubble land intended for roots or forage crops should be ploughed if possible.

Twitch-infested stubbles require careful treatment. It is bad practice to leave fallow over the winter land that has been finely worked in the autumn by cultivation for twitch. It is impossible to drag out all the twitch roots, and any that are left will grow with great vigour in the finely worked seed-bed. Stubble land infested with twitch should not be followed by roots, but by some smother crop. The stubble land should be skim-ploughed immediately after harvest, and all the surface twitch worked out with the tine cultivator, rolled up with the chain harrows, and burnt; the land should then be deep ploughed and sown immediately in a smother crop. The two best smother crops are oats and vetches for hay, or Italian rye-grass. Oats and vetches make a dense sward which practically prevents any light getting to the surface soil, and so checks the growth of any twitch remaining in the land. This crop also has the additional advantage

that it can be sown fairly late—April or May ; but, on the other hand, its production does not usually suit the economy of the ordinary arable farm which is mainly devoted to the production of fat lambs. Italian rye-grass provides the fat-lamb raiser with an excellent feeding crop, but unless it is got in by the end of March or early April it usually fails to make the vigorous growth so necessary for the production of a dense sward to keep the twitch under control.

In South Island arable farming districts most of the short-rotation grass is sown down with oats in the spring or rape in November, and it is rare for a short-rotation pasture to be autumn-sown after a cereal. Sowing at these periods allows of cheap establishment of the pasture, the cost of cultivation of the land being paid for by the rape and oat crops. In the North Island, however, long-rotation and permanent pastures are often autumn-sown after oats. Although a cereal may not leave the land in an ideal condition for grass, it is frequently very difficult to choose any alternative crop to precede the grass which will allow of the pasture being sown early in the autumn. When grass follows summer forage crops the seed-bed often cannot be prepared till late April, which in many seasons is rather late for the best establishment of the clovers and grasses. When preparing the seed-bed for grass after cereals it is important to get the land ploughed as early as possible. This allows of full benefit being obtained from the weathering effect of the autumn rains. Early sowing is preferable to late sowing, as it allows the clovers to become well established before the early winter frosts, but in very dry seasons sowing should be delayed until rain has fallen and a good seed-bed has been obtained ; this gives better results than early sowing on a dry and badly prepared seed-bed.

STOCK-MANAGEMENT.

A fairly large proportion of the sheep offered at the annual sheep fairs are very poor in condition, even in seasons when the growth of grass has been quite good. It is probable that by general adoption of the best management and feeding practices the condition of the sheep could be greatly improved to the mutual advantage of both the grazier and fattener. This applies particularly in the case of ewes culled for age by the grazier and used by the mixed farmer for fat-lamb raising. At practically all sheep fairs one notices drafts of four- and five-year-old ewes that are in very poor condition, and consequently bring a poor return to the grazier and are often a doubtful investment for the mixed farmer. The general practice is to cull the aged ewes from the main flock at weaning-time ; the best practice, however, is to divide off the old ewes the year previous to culling, and during the next breeding season keep the old ewes separate from the rest of the flock. Practically all grazing-runs provide sufficient subdivision to allow of these older ewes being kept separate from the rest of the breeding-ewes, thus making it possible to give them the best of the grass right through the season. In many cases they could be lambed slightly earlier than the rest of the flock, and this, together with the better feed and the absence of competition with the younger sheep, would put them in good condition and enable them to do their lambs well. They should then be in good condition in February when finally culled for age, and realize a fair price at the sheep fairs.

On the fat-lamb-raising farms in the North Island the rams are usually put out at the end of February or early in March. Flushing, by feeding the ewes on some succulent feed for a week or ten days before the rams go out, helps to increase the lambing percentage. Flushing can be done by running the ewes on rape after the first feeding off by the lambs, or, where there is no rape, on the best pastures available.

The supplementary feeding of dairy cows during dry autumn weather should receive careful attention. The feeding of green crops, roots, or ensilage should commence before the grass-growth goes off badly and the milk yield falls, as it is much more difficult to raise the yield once it has fallen than to maintain it by supplementary feeding.

—*P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.*

THE ORCHARD.

SPRAYING.

THE spraying season is gradually drawing to a close for this season's crop, but that does not imply that operations should cease at once, there still being ample time for pests and diseases to do much damage before the later varieties of apples are harvested. Codlin moth and leaf-roller caterpillar will still be active, and must be controlled by sprayings with arsenate of lead—driving the spray with considerable force, so that every part of the tree will be covered. Much fruit is rejected for export on account of codlin-moth stings and the eating of the skin of the apple by the leaf-roller; consequently every precaution should be taken by getting in first with the spray, and thus turning into profit apples that might otherwise be wasted. Black-spot has been known to make its appearance late in the season, especially on varieties like the Dougherty, and a lime-sulphur spray towards the end of the coming month will often prevent an attack.

From now on till picking-time growers should as far as possible arrange their spraying so as to reduce spray stains to a minimum. This applies more especially to export fruit, although apples covered with spray stains are unsightly for the local market. If it is found necessary to spray with the lime-sulphur, Black Leaf 40, and arsenate-of-lead combination for the control of red mite, leaf-hopper, &c., late in the season, it may be advisable to spray the trees with clear water just prior to picking, as the residue from this spray gives the fruit a dirty appearance, necessitating wiping before submitting for export.

REWORKED TREES.

Where trees grafted this season have not yet received any attention a number of growths will be showing from the limbs below the grafts. It is not advisable to destroy all those until the grafts have made a fair growth, and then sufficient should be left to ensure that a good balance is maintained between foliage and roots. These growths may be occasionally pinched or stopped to

stimulate the development of the graft. A strong, suitably placed growth should also be selected where any scion has failed to grow at grafting-time. This can be budded during January or February.

HANDLING THE CROP FOR EXPORT.

There is every indication of a very large export of apples this season, and although the importance of careful handling of the crop for shipment has been emphasized during the past few seasons some of the chief points may be restated. Export starts in the orchard, although the practice adopted by some growers might lead one to believe that the actual wrapping of the apple and placing it in the case rectifies every mistake made previously, and satisfies all requirements. It would be quite safe to say that orchardists are losing hundreds of pounds every season through careless picking. The apples are pulled from the tree, with the result that either the fruit spur comes away with the fruit, or the stalk, with a portion of the apple, is left attached to the fruit spur, rendering the apple useless for export. Should the stalk be intact it will be ruptured so badly as to cause the apple to rot. Growers will do well to caution their pickers against carelessness in this respect.

When grading, either by hand or machine, the less the apples are handled the better. The common practice of dropping the apples, instead of placing them, increases the chance of bruising. A little extra time spent when sizing and grading is well worth while, and makes the packing of the fruit much easier. Careful study of the regulations governing grading, sizing, colour, russet, &c., will simplify matters, and probably save rejections when the fruit is submitted for examination. The apple packing charts now issued are so complete and full of details that even an inexperienced packer can hardly make a mistake, providing an average amount of common-sense is used.

The experience gained with the Canadian case last season will enable packers to start with more confidence this year, and a good pack should result. No doubt the various reports from overseas have been considered; any points for the good of the fruit-grower and the placing of our fruit on the market in the best possible conditions should be acted upon. Competition is keen, and it is only by attention to all details that we can hope to retain the high position our fruit now holds on the overseas markets. Record making or breaking is not required when packing apples for export. Uniform sizing, good grading, neat wrapping, fairly loose packing creating large pockets, and a good bulge are the essential points required in packing the new case. There is still room for improvement in the labelling and stamping, and growers should realize that general appearance does much towards sale of the fruit.

—*G. Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

With prolonged dry weather citrus-trees will be retarded and suffer a loss of foliage according to the amount of moisture available. Continued cultivation is the first essential to conserve moisture; the

destruction of weeds is also very necessary, as much moisture escapes from the soil through these growths. Wherever rough litter such as hay, straw, or stable manure is available this should be spread over the rooting area to form a mulch, affording protection against evaporation and maintaining a more equable soil temperature.

Irrigation is not necessary, as a rule, in citrus groves, but there are occasions when it could be used to advantage. Citrus-trees make their greatest demand on the water content of the soil during the period of minimum rainfall, and satisfactory growth and development cannot take place when moisture is not available. It is worth considerable effort to supply water, and the response will often save defoliation and loss of crop. Applications of water are best given in trenches, which should be levelled down after the water has soaked in.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

SELECTION OF BREEDING MALES.

THE early-hatched cockerels should now be carefully gone through and the best specimens selected for future breeding purposes. In this important work it is always a wise course to select about double the number of birds that will be required for the next season. This is because even the most promising specimen now may later on develop some serious defect or weakness which would condemn it as a breeder. Thus, unless due allowance is made by having good numbers for the final selection, annoyance and disappointment may be easily experienced when the next breeding season comes round.

In the selection of breeding males the necessity of giving points indicative of health and vigour the first consideration cannot be too strongly urged. The chief signs of this condition are a bright, prominent eye, face free from feathers, good bodily development (especially in front), width across the back, tight feathering, sturdy legs set wide apart, and generally an alert active appearance. Always beware of the extremely early maturing male. During the early growing stages it may look a pretty little bird, but it usually remains a pretty little bird, and being a diminutive specimen it should not be bred from. Usually it is the big-framed, slow-maturing cockerel, possessing the points as indicative of health and vigour, which makes in the long run the best male to head a breeding-pen. In addition to the other desirable points mentioned an endeavour should always be made to select birds that conform to breed-type, or, in other words, standard requirements of the breed they represent.

After the best birds have been selected they should whenever possible be given a free range. It should be borne in mind that the more natural the conditions the young birds are placed under the more naturally will they develop. Confined quarters are always undesirable for the future breeding male. They not only tend towards unhealthy growth through weak legs, &c., but the production of large falling-over combs is also encouraged. The latter point, of course, chiefly applies to heavy combed breeds such as Leghorns, Minorcas, &c.

It is a mistake to give the promising breeding cockerel too much forcing food such as meat and milk, as these tend towards a forced but weak development. A liberal but plain nourishing ration should be provided. Above all, the quarters should be kept strictly clean and free from insect pests, otherwise sound development cannot take place.

BREEDS FOR THE FARMER.

A correspondent wishes to know which is the best breed of fowl for the farmer to keep for profit-making. The answer is that there is no best breed. There are good and bad layers in all breeds, as the egg-laying competitions have undoubtedly proved. The results of these tests go to show that there is often as much difference in egg-producing capacity between birds of the same breed as there is between the different breeds. Thus in choosing a breed the matter of strain and constitutional vigour are the chief points for consideration, providing, of course, that the breed selected is of an egg-laying type. At the present time throughout New Zealand the White Leghorn is the most popular breed, but being generally a non-sitter it cannot be regarded as an ideal farmer's bird, except in cases where artificial methods are used for the hatching and rearing of stock.

It will thus be seen that the question of local conditions must also be taken into account. This being so, the novice should select a breed that will best suit his own individual requirements. On the farm, where generally hatching and rearing are carried out in the natural way, one of the heavier breeds such as the Black Orpington or White Plymouth Rock is recommended. Given a good laying strain of these breeds, they should possess the combined qualities which go to make an ideal farmer's bird. While at the present time the White Leghorn is mostly favoured for heavy egg-production, and the Black Orpington as a dual-purpose breed, it is to be regretted that many breeders of the Orpington, in their desire to increase egg-production, have robbed it of some of the qualities which were considered of paramount importance when the breed was first established. The object aimed at was to produce what might be termed a triple-purpose breed—a fairly good layer, a good table bird, and one which could be depended upon for the hatching and rearing of stock at the right season of the year. Unfortunately, to-day in many cases the Black Orpingtons seen, as a result of continuous breeding for egg-production, and by the introduction of Mediterranean blood, have been fined down to such a degree that they fail to provide even a decent table carcass. Moreover, with the broody propensity being more or less eliminated, they cannot be depended upon for the hatching and rearing of stock till probably too late in the season for the chickens to do their best. Obviously such stock, and particularly if they lay undersized eggs, have few if any qualifications to recommend them as a farmer's bird compared with a White Leghorn which conforms to the utility standard weight requirements.

From a farmer's standpoint, if he is to have chickens bred to lay during the dear-egg season, there are two alternatives: he must either use incubators for hatching or purchase day-old chicks from a reliable breeder and rear them in an up-to-date brooder. With the improved incubators and brooders now on the market, and the knowledge available

in regard to their working, the production and rearing of chickens is not nearly so difficult as is usually imagined by those who have not had experience in this work.

COMBS AND WATTLES.

Another correspondent asks whether a large comb carried by a hen is a sure sign that she is a good layer. The answer to this is that the comb is merely an ornament, and its size does not necessarily indicate egg-producing power. In days gone by most of the Mediterranean breeds had large combs, and as these were generally looked upon as the best layers it was therefore believed, and is still thought by many, that to breed from birds with the largest combs was to breed for the best layers. This view, however, does not hold good to-day, as there is ample evidence that many of the birds which have produced record yields in the egg-laying competitions and elsewhere carried a more or less medium-sized comb of their breed. In my opinion, breeding for excessive combs directly injures a strain from a utility standpoint. A large heavy comb is apt to fall over to such an extent as to prevent a hen from seeing with one eye. Obviously such a bird suffers a severe handicap in securing its food as compared with another which has the full use of both eyes. Then again, in the case of a male bird carrying a large comb it is rare if ever that he can be depended upon to produce a high proportion of strong easily reared chicks, unless, of course, the comb is first removed or "dubbed."

The same remarks apply with equal force to extremely long wattles, as these, especially if the bird is fed in deep litter (which is necessary in the majority of breeding-pens), prevent it from feeding to the best advantage, with a consequent falling-off in condition. Large combs and long wattles usually go together. They may be all right from a fancier's point of view, but when profit-making is the object aimed at no good can be claimed for them. Even for the table bird a large comb has no special value whatever, as it is always cut off and thrown away.

In our utility-poultry standards a more or less medium comb is aimed at, and it behoves all breeders and judges of utility stock to do all possible to bring about this much needed improvement. Although the comb may be looked upon as merely an ornament, every endeavour should be made to breed birds with combs conforming to standard requirements. The aim should be to combine beauty—in other words, breed-type—with usefulness.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

TAKING SURPLUS HONEY.

WHERE the beekeeper has succeeded in getting his colonies into good order for the honey-flow there should be some honey for extracting by the end of the month. If the stocks of surplus combs on hand are not sufficient to harvest the crop there is a danger that the immediate requirements of the bees may not be met. It is well,

therefore, to look over the upper stories and note those which contain sealed honey. These can then be removed and extracted, and returned to the hives to be refilled.

In this early extracting great care must be exercised not to remove any combs but those which are fully sealed, as in the height of a honey-flow much unripe honey will be present in the hives, and this, if extracted, is likely to ferment. The practice of extracting from unsealed combs during a flow cannot be too strongly condemned, as it results in the production of honeys of poor flavour, coarse grain, and low specific gravity. All partly sealed combs should be left on the hives until after the flow, in order to get the honey in them well ripened.

Extracting during a flow has advantages, providing the above precautions are taken, as fewer combs are required and little or no robbing has to be contended with during the tedious process of removing honey from the hives. Where ample stocks of combs are on hand to meet the demands of a large flow the hives can be supered as required, when the work of dealing with the crop may be left until the end of the season. If this practice is followed the beekeeper will be assured of a well-ripened honey of good quality and high grade.

USE OF BEE-ESCAPES.

For removing honey from the hives there is no better device than the bee-escape. The usual practice followed when the time for extracting is at hand is to remove the frames one by one. If excluders are used much time will be saved in picking over the combs. As the combs are taken from the hives shake the bees in front of the hive, brush off the remaining ones, and place the combs in a hive body for removal to the honey-house. Some beekeepers practise removing full supers, which are bumped on the ground to cause the bees to fall from the combs. This is not a good plan, as during the operation many bees are killed, combs are broken, and robbers are soon in evidence. Others practise smoking between the combs excessively, in order to get the bees out of the supers. There is danger in this method of demoralizing the colony, resulting in it being an easy prey to the robber bees, and causing the attendant risk of injuring the quality of the honey by tainting it with smoke.

There is no more satisfactory way of getting the bees out of the supers than by the use of escapes, and when their advantages are weighed it is a matter of surprise that they have not been more largely adopted. There is no stinging, smoking, brushing, or robbing when the honey is removed. Escapes are now made for the greater part of wire cloth. The advantage of this is that it allows the warmth from the bees to pass into the super during the night, thus keeping the honey warm; the bees can also clean up the drips of honey that fall from the burr combs. In inserting the escapes gently prize up the super from the brood-chamber and insert the device. A puff of smoke will suffice to control the bees while the operation is being performed. If this is done late in the afternoon the bees will have gone down to the brood-chamber before the following morning, and the honey can then be taken off without disturbing them. A word of caution to those who have not formerly

used the escapes: Should there be brood in the super combs the bees will not leave, and the escapes will not prove effective in ridding the supers.

FOUL-BROOD.

Opportunity should be taken when removing the surplus honey to make a searching examination of the brood-chamber for disease. In this matter the beekeeper should ever be on the alert, and if disease is noticed in any of the colonies the surplus honey from such should be set aside to be extracted when all other extracting is finished. Many beekeepers spread the trouble by careless handling of diseased colonies at extracting-time. The combs from infected hives should be sterilized or destroyed after the honey has been extracted.

HONEY-HOUSE.

It may be well to remind beekeepers who have only a few colonies and who make use of existing buildings for extracting, of the requirements of the regulations under the Sale of Food and Drugs Act. These provide that "every place used for or in connection with the sale, manufacture, preparation, storage, or packing of any food for sale shall be used for that purpose only; and no place shall be so used which is at any time used as a sleeping apartment, or in which any animal is allowed to be, or which is or has been used for any purpose which would be likely to contaminate such food or injuriously affect its wholesomeness or cleanliness."

The above conditions make it obligatory on the part of the beekeeper to exercise scrupulous care and cleanliness in handling honey as an article of food. The first requisite is a bee-tight house, having wire cloth screens fitted with escapes on the windows. These screens are necessary to allow bees which enter with the supers to escape, and to prevent the entry of robber bees which are attracted by the smell of the honey. Now that electric light is available to most beekeepers it will be found to be a distinct advantage to employ it for lighting the extracting room. If this method is adopted the room is best divided into two compartments; the part containing the extractor, uncapping box, and supers of honey can be artificially lighted, thus allowing the bees to pass through the doorway to the window in the end of the storage room. Thus the operator is not hindered by the flying bees, and the tanks do not require to be covered; moreover, any robber bees which may enter will be immediately attracted to the lighted window.

EXTRACTORS.

Extractors are made in different sizes—from two to six frames. In the choice of an extractor a beekeeper will be guided by the number of colonies he is operating. For any number of colonies up to one hundred he will find a two- or four-frame reversible most convenient. For more than a hundred colonies it will pay to install a power machine. A recent decision of the Health Department renders it possible now to use extractors made of galvanized iron without coating them with beeswax internally. The application of wax to the machines was considered necessary in the interests of health. However, this has been dispensed with on the strict understanding that the equipment is kept

in scrupulously clean condition. Too often extractors are left without cleansing after the season's operations, and during the winter the acid in the honey attacks the metal, rendering it well nigh impossible to thoroughly cleanse the machines before they are again brought into use. Apart from this all traces of honey should be removed, as it is liable to ferment, and in the course of time the whole outfit becomes soured and permeated with destructive bacteria.

HONEY-TANKS.

For the preparation and care of the honey after extracting it is necessary to provide suitable tanks. These should be made of tinned steel and externally soldered, in conformance with the regulations under the Sale of Food and Drugs Act. It has been proved by experience of late years that deep, narrow tanks are the most suitable. These tanks obviate to a great extent the disagreeable necessity of straining the honey, and help to eliminate both froth and scum, which otherwise render the honey unsightly when it rises to the surface.

EXTRACTING.

To do the work expeditiously two people should be engaged—one to do the uncapping and the other to operate the extractor. In the process of uncapping the comb is placed on the cross-bar on top of the uncapping can. The projecting screw point prevents the frame from slipping and acts as a pivot on which to revolve the combs. The comb should be placed with one end resting on the pivot and tilted slightly forward, in order to allow the cappings to fall away from the combs as they begin to peel off. For removing the cappings what is known as the Bingham knife is usually first favourite. Provision must be made to keep the knife warm, and this can be accomplished by immersing it in hot water. The knife should have a keen edge, and be thoroughly clean before starting operations. Uncapping should commence at the bottom, and the knife proceed with a forward and backward motion, the same as when using a saw. Make a practice of uncapping as wide a surface as possible, and endeavour to remove the entire surface of the comb without once removing the knife. A little experience will enable the operator to cut below the surface of the cappings, remembering the cleaner the cut the freer the honey will be of wax particles when extracted.

After the combs are uncapped the problem of dealing with the cappings must receive consideration. Where these are stored for an indefinite period the honey may granulate or take up moisture from the atmosphere and thus become a total loss. If the beekeeper does not possess one of the melters in general use he should improvise some means for straining them. A hive-body covered with coarse wire cloth at the bottom and placed in a tray with a lip provided at one end to drain off the honey will answer the purpose for small quantities of cappings. For dealing with large quantities it is well to install a good melter, but before doing so the beekeeper should satisfy himself that it will not impair the quality and colour of the honey.

RETURNING THE COMBS.

After the combs are extracted they should be placed on the hives in the evening. If this practice is followed the bees have a chance

to clean them during the night, and robbing is not likely to follow. Nothing will excite the bees more than wet combs placed on the hives during the day; they promote wholesale robbing, and, moreover, the bees take advantage of the opportunity to enter the honey-house every time the door is opened.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

HARVESTING THE TOBACCO CROP.

THE earlier planted tobacco crops will now commence to mature their leaves. This is indicated by a change in colour and texture from a dark green colour and pliable condition to a yellowish green and a more brittle leaf. Sometimes the yellow colouring develops in spots and patches. This change first takes place in the lower leaves, and gradually spreads to those higher up on the stalk. For this reason in countries where labour is abundant the priming method of harvesting is sometimes adopted. The individual leaves are gathered as they ripen and attached to the curing sticks which are hung in the barn to cure, thus securing the greatest possible uniformity and a maximum of first-grade leaf. More usually it is the custom to harvest the leaves and cure them on the stalk by splitting the stalk to within a few inches of the ground and then cutting it off just above ground level. The plants are then left for a few hours to wilt; they are then threaded on the curing sticks and placed in the curing barn.

It is desirable to harvest the tobacco crop during the warmer weather, as the leaves then carry the natural secretions which give them aroma and other desirable qualities when cured, also the natural high temperatures facilitate the work of a successful cure. For some of these reasons it is desirable to avoid cutting after heavy rains when the leaves are thin and in comparatively poor condition. Every consideration should be given to the operations of harvesting and curing, as an excellent crop may very easily be spoiled by any mismanagement. Leaf that is immature will retain a greenish colour when cured and have a bitter flavour, while overmaturity results in uneven colouring without the desirable elasticity in the cured leaf. Great care is needed in all handling to avoid bruising the leaf, as such injuries will cause discoloration and lower the grade. All plants should be free of dew and moisture before cutting and be placed under cover the same day as they are cut; it is not desirable to leave any outside over night.

In the curing shed the sticks threaded with tobacco plants are placed with the ends resting on parallel scantlings, known as tier poles, in such a way that they will just hang clear and allow a current of air to pass through them. There are usually two or three such tiers 3 ft. to 4 ft. apart.

It is desirable, if possible, to keep the atmosphere a little close at first to further develop the yellow colour in the leaf, and later to induce a drier atmosphere by opening the ventilators and so fixing the desirable colour. This air-curing is the natural method, and is

used chiefly for pipe and cigar tobaccos. In the case of cold, wet weather while this operation is taking place there is a danger of the leaf rotting, a condition known as "pole-sweat"; or during a period of warm winds if the leaf is dried out too qiuckly it will retain a green colour with poor flavour. Under the former circumstances small fires of dry hardwood placed about the floors will improve the conditions. At this season, however, the weather is very suitable for carrying out the operation of curing with the least danger and difficulty.

For curing the light-coloured leaf that is in such demand for cigarette tobaccos a heated flue kiln is required. This is usually 20 ft. square and nearly as high, with a large metal flue running round three sides at floor-level. Considerable experience is necessary to operate it successfully. The kiln is fully charged by hanging the plants in tiers as mentioned above; the kiln is then tightly closed and the fires lit. The heat radiates from the flues, but the smoke passes through a smoke-stack into the open air. The general method is to start with small fires and raise the temperature gradually. Meanwhile in the humid warm conditions created the leaf gradually assumes the requisite yellow colour. By further increasing the temperature, and reducing humidity gradually by means of ventilation, the leaf is dried out and the colour maintained. To do this well the nicest judgment and adjustment are required, but under proper management high-grade leaf may be cured in a week, as compared with the six weeks or so required for air-curing, although the latter method requires less skill and attention and larger barns can be used.

TOMATOES.

The hard season has revealed very plainly the value of the advice often given to raise sturdy tomato plants of good strain in moderate heat, and thoroughly harden them off gradually. Such plants have stood the severe test of a cold season successfully. Other types are uneven in growth and attacked by disease. In this weakened state they have fallen easy victims, and any amount of spraying only results in a meagre crop some time after the usual date for the first picking. This condition is specially noticeable in the outside crop. The best preventive of disease is a vigorous plant of good constitution.

The season for the inside crop is about over, and the success of next year's crop will very largely depend on the preparations that are commenced now. Instead of neglecting the glasshouses and allowing them to breed disease, the roots of the plants should be lifted and the plants left in the strings to dry out. They should then be gathered and put on the fire heap. This fire should be a well-thought-out installation. A sufficiently large cutting in a bank, with a few fire bars to keep the heap off the ground and prevent rotting and to facilitate kindling, is a good arrangement, and it makes a first-class incinerator. The ashes obtained make a good contribution to the compost heap.

Thoroughly clean down the house by spraying or fumigation, and sterilize the soil as may be required. Scarify-in a quick-growing cover-crop, and grow it with ventilators wide open. This is the most effective way of destroying insects and fungi before they get established and settle down into their winter quarters. It also supplies humus and nitrogen in a clean and suitable form.

Growers will now be busy marketing the outside crop of tomatoes. These, if suitably graded and packed, should be profitable if they are well distributed. There is often a tendency to ship automatically to the nearest big centre of population, and such markets are too often glutted while provincial demands are not supplied. The subject of distribution is never finalized, and demands the very alert attention of the producer at this season.

SMALL-FRUITS.

Most growers of raspberries and loganberries will now have completed their harvest, and the old canes should be cut, carried out, and burned. Remove also all small useless growth. The cropping canes may then be fed with suitable manures as required. Most plantations are attacked by scale or other insects and fungi; one or two applications of a suitable spray at the present time would be most effective in countering these attacks.

Where strawberries are to be planted the preparation of the land should now be completed. Where it is customary to crop the beds for three or four years it is of special importance that this preparation should be thorough, particularly as regards such bad weeds as couch-grass and sorrel. If the preparation in this respect has not been successful it is not advisable to plant strawberries. It is surprising to notice how often planting is done on such infested areas, where disappointment is inevitable. Complete the preparation by obtaining a firm bed with a fine even surface, and put out the plants as soon as they are obtainable—especially in southern districts.

A similar preparation should now be made for small-fruits to be planted out in early winter. Sow seeds of Cape gooseberry and passion-fruit to produce plants for putting out in the spring.

VEGETABLE CROPS.

Harvest crops of onions, shallots, early potatoes, &c., as soon as they mature. There is considerable risk of second growth if the crops are allowed to remain in the ground and get the autumn rains after that stage is reached. If the onions are of a non-keeping kind, grade them as the market requires, and pass them into consumption; keeping sorts should be thoroughly ripened and placed in a dry airy place. Large stocks require careful supervision.

The potato crop for consumption is best kept in a dark cool shed of considerable humidity, in order to avoid greening and shrivelling and sprouting. The results of next season's crop will be enhanced if the seed is chosen from the best plants of true type. These tubers are best ripened in the light, but care must be taken to avoid shrivelling and attacks of the potato moth, which is sometimes about.

Among the newly sown and planted crops the weeds will quickly get ahead once the autumn rains really begin. To control them take advantage of fine weather to hoe the crops, and do it before the weeds attain much size.

Keep the celery and other winter crops moving. Water and feed crops of the gourd class. Sow spring cabbage and cauliflowers, also spinach, parsley, and lettuce.

—*W. C. Hyde, Horticulturist, Wellington.*

TESTING OF PUREBRED DAIRY COWS.

DECEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

DURING the past month of December ninety-five cows received certificates under the C.O.R. system. Details of the records are given in the following list :—

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Ivondale Gold Bird ..	G. A. Mills, Ngahinapouri ..	1 349	240·5	365	12,091·5	573·38
Holly Bank Mary ..	J. Nicolson, Hawera ..	1 347	240·5	365	9,826·9	544·60
Woodstock Farewell..	Mrs. A. Banks and Son, Kiwitea	2 44	244·9	365	9,337·8	540·87
Jerseydene Ruby ..	T. Wells, Awakino Point ..	2 10	241·5	365	9,639·9	540·87
Linda of Adare ..	G. A. Mills, Ngahinapouri ..	1 238	240·5	365	8,602·8	483·98
Conandale Model's Pryde	S. Dale, Fairlie	1 295	240·5	364	7,516·3	468·80
Brentwood Caprice ..	C. A. Willis, Pukekohe ..	1 318	240·5	365	9,039·6	453·49
Glenmore Rosette ..	A. C. Lovelock, Woodville	2 13	241·8	365	7,159·8	450·06
Holly Oak Waterwings	G. A. Mills, Ngahinapouri ..	1 354	240·5	365	8,686·8	447·34
Te Aute Tinsel ..	W. T. Williams, Pukehou ..	1 362	240·5	365	7,696·0	439·96
Burnside Winsome ..	S. J. Hollard, Rowan ..	2 43	244·8	365	8,243·0	435·46
Kuku Perfection ..	R. L. Horn, sen., Ohau ..	2 56	246·1	365	8,820·7	427·35
Uruti Martha ..	W. Oxenham, Uruti ..	2 26	243·1	362	6,861·1	421·38
Woodstock Zena ..	Mrs. A. Banks and Son, Kiwitea	1 361	240·5	365	7,794·5	419·96
Jersey Meadows Jewel	H. H. Phillips, Te Rehunga	2 25	243·0	365	6,821·8	402·26
Craigalea Topsy ..	J. G. Robertson, Eltham ..	2 16	242·1	353	7,402·6	402·01
Clar Innis Lynnette ..	A. Buchanan, Palmerston N.	2 7	241·2	365	6,489·0	401·23
Glenmore Lena ..	A. C. Lovelock, Woodville..	2 45	245·0	322	7,034·3	400·61
Ohape Graceful ..	W. Westaway, Temuka ..	2 69	247·4	365	6,295·2	382·77
Jersey Lea Chance ..	J. T. Entwisle, Cambridge..	2 29	243·4	365	6,662·3	376·57
Courthay Dolly Dimple	P. C. Short, Lowgarth ..	1 301	240·5	365	5,912·1	344·34
Maesbury Judy ..	C. Bowles, Burwood ..	2 17	242·2	332	5,821·9	343·11
Dominion Delight ..	Ruakura Farm of Instruction, Hamilton	1 348	240·5	351	5,635·1	324·12
Woodlands Bright Hope	W. Oxenham, Uruti ..	1 325	240·5	291	6,011·3	317·92
Courthay Snowflake	P. C. Short, Lowgarth ..	1 344	240·5	365	5,876·3	300·71
Daisy's Princess ..	C. P. Crowley, Kaponga ..	2 70	247·5	306	4,734·4	288·39
Senior Two-year-old.						
Dominion Golden Floss	Ruakura Farm of Instruction, Hamilton	2 354	275·9	365	12,287·3	663·14
Ivondale Pure Gold ..	W. H. Jakins, Christchurch	2 336	274·1	365	10,531·3	581·68
Glenmore Sensation ..	A. C. Lovelock, Woodville..	2 348	275·3	365	8,019·1	526·15
Dorothy's Dolly ..	A. S. W. Hazard, Waimate N.	2 361	276·6	365	8,352·5	490·44
Woodstock Floral ..	Mrs. A. Banks and Son, Kiwitea	2 347	275·2	365	7,954·8	425·19
Woodstock Freda ..	Mrs. A. Banks and Son, Kiwitea	2 241	264·6	328	6,880·5	408·23
Dominion Golden Fancy	Ruakura Farm of Instruction, Hamilton	2 344	274·9	303	8,334·2	401·48
Beauty's Queen ..	A. E. Sly, Whakaronga ..	2 95	250·0	350	6,999·0	374·46
Middlewood Glory ..	A. Stackhouse, Kiwitea ..	2 110	251·5	299	5,353·9	310·19

LIST OF CERTIFICATES—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued*.					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Holly Oak Primulet ..	Kilgour Sisters, Kiwitea ..	3 282	305·2	365	12,008·4	698·22
Pawa Shell ..	F. S. McRae, Palmerston N.	3 339	310·9	365	11,297·8	601·78
Dominion Avis ..	Ruakura Farm of Instruction, Hamilton	3 319	308·9	365	10,422·0	560·21
Maid's Farewell ..	D. Marra, Dargaville ..	3 84	285·4	365	9,241·3	538·94
Craigalea Ruby ..	J. G. Robertson, Eltham ..	3 25	279·5	365	7,787·9	511·15
Rosedale Queen Elizabeth	E. J. Adams, Puni ..	3 72	284·2	353	9,635·8	441·20
Distinction's Magnet	A. Hyland, Thornton ..	3 306	307·3	365	8,794·3	435·56
Leighurst Coquette ..	R. K. Garland, Okauia ..	3 349	311·9	364	8,385·2	398·11
Twin Flower ..	J. Torbet, Waiau Pa ..	3 233	300·3	365	7,902·6	392·31
Greenbank Geisha ..	W. A. Burgess, Ruawai ..	3 102	287·2	359	6,846·3	384·60
Aldan's Glory ..	G. R. and H. Hutchinson, Auckland	3 343	311·3	297	6,813·6	382·53
Four-year-old.						
Middlewood Daisy ..	Kilgour Sisters, Kiwitea ..	4 51	318·6	365	9,866·9	611·06
Woodstock Bargee ..	Mrs. A. Banks and Son, Kiwitea	4 37	317·2	365	8,954·9	487·63
Dominion Rozena ..	Ruakura Farm of Instruction, Hamilton	4 350	348·5	365	10,120·3	468·04
Strathlea Sunshine ..	H. H. Phillips, Te Rehunga	4 356	349·1	357	7,598·7	406·64
Dunira Delight ..	W. K. Mackie, Dargaville ..	4 19	315·2	345	7,681·8	391·86
Mature.						
Flandrine's Vixen ..	R. E. Clements, Awakino Pt.	7 325	350·0	365	12,598·8	722·42
Picotee's Nancy ..	N. Moore, Tapanui ..	8 293	350·0	365	10,713·1	662·84
Dominion Flo ..	Ruakura Farm of Instruction, Hamilton	9 60	350·0	365	12,308·0	637·63
Ivondale Darkie ..	S. G. Morgan, Woodville ..	6 56	350·0	365	11,495·4	623·12
Fleurange	D. Kennedy, Morven ..	5 46	350·0	365	10,186·6	614·74
Sweet Clematis ..	A. O. Brown, Kamo ..	5 20	350·0	363	9,174·8	610·01
Woodstock Fantail ..	Mrs. A. Banks and Son, Kiwitea	6 13	350·0	365	10,723·2	604·65
Jersey Meadows Iris	H. H. Phillips, Te Rehunga	8 43	350·0	317	9,703·4	573·30
Flight's Folly ..	N. Moore, Tapanui ..	8 319	350·0	365	9,551·4	507·67
Dominion Blue Bird..	Ruakura Farm of Instruction, Hamilton	5 5	350·0	365	9,098·2	499·56
	FRIESIANS.					
Junior Two-year-old.						
Dominion Betty Frisby	Central Development Farm, Weraroa	2 76	248·1	350	12,491·6	420·30
Hobson Nettie Pontiac†	Hobson Farm, Ltd., Wharepapa	2 125	253·0	365	11,517·0	406·82
Hobson May Pontiac†	Hobson Farm, Ltd., Wharepapa	1 330	240·5	327	10,244·9	361·80
Hobson de Kol Lady†	Hobson Farm, Ltd., Wharepapa	2 38	244·3	350	10,316·6	355·49
Hobson Rag Apple Pontiac†	Hobson Farm, Ltd., Wharepapa	2 54	245·9	362	9,090·4	327·92
Hobson Ashburn Pontiac†	Hobson Farm, Ltd., Wharepapa	2 52	245·7	319	8,780·7	322·34
Hobson Pet Mercedes†	Hobson Farm, Ltd., Wharepapa	2 87	249·2	314	8,114·4	304·80
Hobson McKinley Posch†	Hobson Farm, Ltd., Wharepapa	2 64	246·9	305	8,651·1	294·28

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
FRIESIANS—*continued.*						
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Hobson Tinie Johanna†	Hobson Farm, Ltd., Wharepapa	2 4	240·9	365	9,091·5	293·80
Hobson Princess Acme†	Hobson Farm, Ltd., Wharepapa	2 71	247·6	326	8,354·2	289·06
Hobson Sunflower Pontiac†	Hobson Farm, Ltd., Wharepapa	1 340	240·5	315	8,379·2	269·23
Senior Two-year-old.						
Dominion Olga Colantha	Central Development Farm, Weraroa	2 355	276·0	365	12,016·5	423·41
Junior Three-year-old.						
Fendalton Sylvia Posch*	J. I. Royds, Christchurch ..	3 50	282·0	365	18,145·3	580·37
Empress Pontiac Valdessa†	Hobson Farm, Ltd., Wharepapa	3 146	291·6	342	11,935·0	389·62
Hobson Sunflower Segis†	Hobson Farm, Ltd., Wharepapa	3 106	287·6	263	8,830·0	295·12
Junior Four-year-old.						
Pareora Hero Fancy*	A. S. Elworthy, Timaru ..	4 64	319·9	365	16,555·1	663·21
Senior Four-year-old.						
Oakland Springhill 2nd†	Hobson Farm, Ltd., Wharepapa	4 309	344·4	305	11,703·3	457·92
Mature.						
Fendalton Alcartra Rozine*	J. I. Royds, Christchurch ..	5 10	350·0	365	19,907·7	667·36
MILKING SHORTHORNS.						
Senior Four-year-old.						
Dominion Mignonette of Ruakura	Ruakura Farm of Instruction, Hamilton	4 347	348·2	344	12,713·7	378·47
Mature.						
Dominion Sis of Ruakura	Ruakura Farm of Instruction, Hamilton	6 300	350·0	283	10,440·2	391·53
AYRSHIRES.						
Two-year-old.						
Dominion Cherry Lass	Ruakura Farm of Instruction, Hamilton	2 80	248·5	361	9,543·1	406·67
Dominion White Blair	Ruakura Farm of Instruction, Hamilton	2 362	276·7	365	9,399·6	394·05
Dominion Daphne's Pride	Ruakura Farm of Instruction, Hamilton	2 238	264·3	342	7,360·8	284·48
Three-year-old.						
Mahoe's Fairy Girl ..	Atkins Bros., Manakau ..	3 16	278·6	332	10,143·8	387·17
Mature.						
Greenfields Sprightly 3rd*	Webb Bros., Levin ..	7 68	350·0	365	16,766·9	632·27
Dominion Newton Jean	Ruakura Farm of Instruction, Hamilton	5 20	350·0	365	11,468·7	390·26

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	RED POLLS.					
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Dominion Miss Superior	Central Development Farm, Weraroa	2 363	276·8	365	11,223·7	443·64
Dominion Bright Eyes	Central Development Farm, Weraroa	2 0	240·5	354	6,244·9	303·54
	Second-class Certificates.					
	Jerseys.					
Two-year-old.						
Kahuwera Topsy ..	Johnson Bros., Pirongia ..	2 7	241·2	365	9,302·7	508·56
Linden Grove Kitty ..	W. R. Jamieson, Parewanui	2 347	275·2	365	7,799·0	498·49
Croydon Princess Charm	W. Crosby, Waipuku ..	1 349	240·5	365	7,539·65	451·27
Three-year-old.						
Ivondale Lady Aster	G. A. Mills, Ngahinapouri ..	3 205	297·5	365	11,601·4	612·29
Four-year-old.						
Bouquet's Carnation	J. A. Blake, Waipawa ..	4 35	317·0	364	8,219·5	430·93
	Friesians.					
Junior Two-year-old.						
Hobson Zozo Pontiac†	Hobson Farm, Ltd., Wharepapa	1 352	240·5	352	11,725·6	448·85

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 17th November to 15th December, 1927, include the following of agricultural interest:—

No. 56688: Sheep-shear comb-plate; F. G. W. Bristow, Sydney, N.S.W. No. 58188: Fencing-standard; A. Christie, Napier. No. 59310: Sheep-shearing-machine tension-nut; R. A. Lister and Co., Limited, Dursley, England. No. 57359: Seed-distributor (for horseback); J. Purchase, Johnsonville. No. 57638: Milking-machine; L. F. Ellery, Invercargill. No. 57946: Hoisting-device; A. J. Pascoe, Lincoln. No. 58048: Cow-cover; E. Jones, Hamilton. No. 59228: Wire-strainer; J. Butel, Mataura. No. 59314: Sheep-shearing machine; A. B. Clark, Sydney, N.S.W. No. 56955: Conversion of motor chassis to tractor; G. Burges, Palmerston North. No. 58545: Drain-plough; E. P. Dickhoff, Shannon. No. 59117: Milk-holder; T. MacDonald, Uruti.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

New Rabbit District.—The Banks Peninsula Rabbit District has been constituted, for the purposes of Part III of the Rabbit Nuisance Act, by Order in Council gazetted, together with details of boundaries, on 22nd December, 1927. The previously existing Rabbit-proof Fencing District has been abolished coincidently.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SPARTINA GRASS.

C. J. CLAASEN, Rawene :—

I enclose cutting from an English paper regarding rice-grass (*Spartina Townsendii*) and would be glad of an opinion on same. Is the grass on the market anywhere in New Zealand, and has it been tried out anywhere here? Do you know if it would be of any use trying to grow it on the heavy mangrove flats of Hokianga Harbour? Has it any feeding-value for stock, and would it be inclined to spread too much?

The Fields Division :—

Spartina Townsendii, also known as rice-grass, has been grown in a few places in New Zealand, but we are not certain whether you can buy roots of the grass on the market. It would be a useful experiment for you to try it on the heavy mangrove flats of Hokianga Harbour. You should sow it on the upper tidal zone; it grows best in the soft mud of the flats. Some roots were distributed from Auckland in 1925. A settler, Mr. A. Glyn Fell, of Waihutu, Opononi, who tried some, reported that the roots spread and were quite vigorous-looking, appearing in little clumps, and he saved some seed. Some roots were also tried at Onerahi, Whangarei Harbour. Mr. K. W. Dalrymple, Bull's (Lower Rangitikei), introduced some plants in 1913, and reported in 1925 that the plants were spreading fairly rapidly, but were slow at first. The grass had collected the mud about itself where it was first planted about twelve years ago. He further remarked that the level was some 2 ft. higher and almost above ordinary tidal level. The evidence we have in New Zealand is too slender yet for any definite opinion to be passed on this grass; experiment will have to be carried further. In England, where they have had over fifty years' experience with Spartina, they do not appear to have decided its value as a forage, but suggest that it may be profitably used for grazing stock, for litter, hay-making, or for the manufacture of paper. One report from Poole Harbour shows that cattle go down to the marshes and eat the plant. It spreads fairly slowly, judging by the experience we have had in New Zealand, and it does not appear that it would become a nuisance, except where it might detrimentally affect navigation in tidal rivers. *Spartina Townsendii* may be (and has already been) confused with Canadian wild rice or rice-grass (*Zizania aquatica* Linn.) found on the Northern Wairoa River. This resembles raupo, and is regarded by settlers fronting the river as a pest. For further information you are referred to the *N.Z. Journal of Science and Technology*, Vol. 7, No. 4 (1924), "Spartina Grass and its Introduction into New Zealand," by H. H. Allan.

DISEASED LEMON-TREES.

W. B., Pukekohe :—

I have two lemon-trees that lost their leaves, with dropping of the fruit. The fruit showed a soft spot on the side, and turned bad if not destroyed by burning or otherwise. Could you advise me what to do under the circumstances?

The Horticulture Division :—

The description given of the condition of the lemon-trees is not sufficient to definitely determine the cause of the trouble. It is very possibly caused by lemon brown-rot fungus (*Pythiacystis citrophthora*), which browns the leaves and causes them to fall, and gradually turns the fruit into a soft spongy condition with a light buff colour. This disease is best dealt with by collecting affected fruit at short intervals and destroying it, pruning the trees so that the bottom branches are 2 ft. to 3 ft. up off the ground, and cutting out all dead and affected wood and burning it. As the greatest danger exists in wet weather, when spores

are produced on infected fragments lying on the ground, it is desirable at such seasons to grow a cover-crop to prevent the distribution of spores by rain-splashes. One or two bordeaux sprays, 4-4-40, when the blossoms fall in spring and autumn, will also assist in a large measure to keep the trees in good health.

REVIEW.

"THE POTATO."

THE disorganization of potato-growing in Britain during the Great War, and the serious consequences attending the rapid spread of wart disease about the same time, stimulated alike the breeder and the pathologist in the production of potato varieties immune to that disease, and focused considerable attention on the causes of degeneration of potato stocks, the classification of varieties, and elimination of synonyms. Much work has also been accomplished in other countries, notably the United States of America, but the records are scattered in journals and bulletins not accessible to the average potato-grower. Much of it is of such great value to the practical farmer, the merchant, seedsman, and gardener that there has been a long-felt want for the accumulated information to be reviewed and presented in a form adapted and available to a wider range of readers.

This has now been filled by a book entitled "The Potato," by Thomas P. McIntosh, B.Sc., published by Messrs. Oliver and Boyd, of Edinburgh. The author is an acknowledged expert, who has for many years been intimately connected with the certification of Scottish seed potatoes and other potato work of the Board of Agriculture for Scotland. His conclusions are the result of close observation and mature consideration. One must acknowledge that too many inaccurate conclusions have been made in attempts to explain observations in potato-growing, and perhaps the outstanding feature of the author's presentation is the reserve that marks any statement which cannot stand close examination, and the manner in which he indicates those general statements which may, and those which may not, be accepted as facts.

The book is very conveniently divided into five parts: (1) Historical, (2) Botanical, (3) Reproduction and Propagation, (4) Cultivation and Utilization, (5) Diseases, Pests, and Injuries. As far as possible each of the thirty-three chapters is complete in itself, so that it may be read independently. The botanical and historical parts will appeal mainly to the potato-breeder, but much of the matter has practical application to ordinary commercial seed-potato production, such as the classification of varieties, intervarietal differences, maintenance of pure stocks, and the roguing of field crops. The reproduction and propagation section deals with application of genetics to variety raising, but deals also in a very practical manner with such questions as quality in seed potatoes, and factors influencing the productivity of potato stocks in connection with disease and its relation to origin of seed.

Certainly the most important section in its application to New Zealand is that dealing with disease. While the potato-grower in this country recognizes the effect of late blight, and through shipping his potatoes has had his attention drawn to certain minor diseases and defects in the tubers, he is almost wholly oblivious to the fact that many of our crops are seriously affected by diseases which do not materially affect the table quality of the tuber, but which cause a very serious reduction in yield. Virus diseases which are the most prolific cause of degeneration or "running out" are very fully discussed in the book, and the excellent illustrations greatly add to the value of the text.

The work makes a notable addition to our literature on the potato, and may be unhesitatingly recommended to interested New Zealand readers. The published price is 12s. 6d. net.

J. W. H.

Correction.—In "Answers to Inquiries," *Journal*, November, 1927, page 355, read: "The relative value of hay to silage is 1 lb. hay equals *3 lb. to 5 lb.* silage," instead of "⅜ lb. silage."

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR, 1927.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows:—

GENERAL SUMMARY FOR DECEMBER.

As has been remarked in the notes for previous months, a prominent characteristic of the present season has been the frequency with which cyclones have controlled the weather in New Zealand, and during December these conditions were to a large extent maintained. With the exception of a rather intense depression which crossed the Dominion on the 6th, the westerly type of pressure distribution was conspicuous by its absence. The depression mentioned caused strong northerly winds generally, and was accompanied by heavy rain in Westland.

Between the 12th and the 19th a remarkable succession of cyclones moved down from a northerly direction off the east coast, their centres passing just eastward of the Chatham Islands. The precise origin of these storms is unknown, but they maintained low pressures, cold, strong, southerly winds, and dull, wet weather in New Zealand, especially over districts with an eastern aspect. Whereas our pressure variations are generally controlled mainly by systems moving from the west, during this very unusual spell conditions over Australia and the Tasman Sea made little impression on the situation which had developed to the east of the Dominion. Some snow fell in the high country in the centre of the North Island, and some heavy rains were recorded on the east coast of the North Island. In Westland, though the weather was cold, no rain fell. Following this period there was a complete reversal of weather type, and the barometer rising persistently, anticyclonic conditions were maintained until the 28th. Fine and warm weather was in consequence experienced over the Christmas holidays. During the night of the 28th and on the 29th fairly general rains were experienced. These were associated with a cyclone which had moved slowly across the Tasman Sea, the centre crossing the South Island on the 29th.

The total rainfall for the month exceeded the normal in the east coast districts of the North Island from East Cape southwards, and at scattered places on the east coast of the South Island only. Elsewhere it was below normal, the deficiency being considerable in all the western districts.

The weather during the month was unusually changeable, with wide variations of temperature. It was not until the latter end that summer conditions became established. Temperatures were on the average considerably below normal, and garden growth was again checked. Shearing operations were delayed by the cold, wet weather. There was, however, ample feed for stock, and the season continues to be on the whole a good one.

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1927, AT REPRESENTATIVE STATIONS.

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1927.	Average Rainfall.
			North Island.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	1·84	9	1·00	3·28	59·87	50·38
Russell	1·15	9	0·35	2·05	54·28	51·79
Whangarei	1·34	14	0·27	2·49	57·20	60·24
Auckland	1·42	12	0·37	2·84	53·56	44·44
Hamilton	1·45	10	0·60	3·72	52·79	50·36
Kawhia	1·72	10	0·37	3·21	62·20	53·98
New Plymouth.. ..	1·66	9	0·69	4·33	63·93	60·35
Riversdale, Inglewood ..	4·31	11	2·05	7·43	101·41	104·48
Eltham	4·10	13	1·99	3·83	60·44	52·43

RAINFALL FOR DECEMBER AND CALENDAR YEAR, 1927—*continued.*

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1927.	Average Rainfall.
			North Island—continued.			
	Inches.		Inches.	Inches.	Inches.	Inches.
Whangamomona	4·17	8	1·12	5·98	74·69	79·50
Tairua	1·92	12	0·52	4·30	60·91	67·18
Tauranga, The Camp	1·71	11	0·44	3·47	59·75	53·10
Maraehako Station, Opotiki	1·18	4	0·64	2·82	63·98	52·82
Gisborne	3·69	9	1·05	2·16	42·23	45·89
Taupo	1·20	5	0·79	3·66	45·01	45·10
Napier	2·62	10	1·22	2·30	31·19	36·11
Maraekakaho Station, Hastings	3·28	14	0·98	2·21	38·22	34·81
Taihape	4·68	13	1·22	3·42	41·05	40·01
Masterton	3·91	11	0·93	2·80	43·78	38·71
Patea	1·76	8	0·90	3·35	48·13	45·19
Wanganui	1·30	7	0·49	2·63	31·94	36·68
Foxton	1·39	7	0·50	2·54	37·93	31·88
Wellington	3·17	12	0·76	3·30	43·35	48·11
			South Island.			
Westport	3·13	10	1·75	6·60	66·52	78·27
Greymouth	3·41	8	1·06	8·95	89·90	99·42
Hokitika	3·63	9	1·76	10·70	108·09	116·60
Ross	6·39	5	3·32	12·04	128·92	136·86
Arthur's Pass	10·25	9	3·37	12·02	171·29	156·61
Okuru, South Westland	6·03	6	2·50	11·73	*	149·73
Collingwood	4·84	5	2·11	8·01	92·18	97·91
Nelson	2·04	5	1·01	2·69	38·43	37·77
Spring Creek, Blenheim	1·50	6	0·73	1·93	29·76	30·59
Tophouse	1·91	5	0·85	5·00	52·86	61·85
Hanmer Springs	4·46	11	0·92	3·26	45·15	41·01
Highfield, Waiau	2·00	7	0·58	2·51	28·43	33·56
Gore Bay	2·53	12	0·84	2·12	33·88	31·21
Christchurch	2·06	12	0·39	2·06	21·36	25·33
Timaru	2·10	16	0·34	2·41	20·42	22·78
Lambrook Station, Fairlie	0·90	7	0·36	2·33	22·38	24·98
Benmore Station, Clearburn	0·77	6	0·42	1·77	20·37	24·79
Oamaru	2·47	13	0·73	2·15	23·93	21·82
Queenstown	0·42	3	0·23	2·55	27·92	30·64
Clyde	..	..	..	1·79	..	15·29
Dunedin	3·79	14	1·06	3·48	46·63	37·06
Wendon	1·25	8	0·34	2·95	31·60	30·39
Gore	1·84	16	0·30	3·41	34·70	35·17
Invercargill	2·36	14	0·64	4·26	43·43	45·98
Puysegur Point	7·73	14	1·52	6·63	99·47	85·55

* Incomplete.

FOOT-AND-MOUTH DISEASE IN BRITAIN.

At date 4th January the High Commissioner for New Zealand in London cabled: "Present position of foot-and-mouth disease is very serious. In November there were 30 outbreaks, distributed as follows: Hants 20, Wilts 8, Bucks 1, Berks 1. During December there were 70 outbreaks as follows: Derby 28, Staffs 10, Warwick 8, Yorks 6, Lincs 5, Notts 4, Lancs 2, Wilts 2, Worcester, Northants, Leicester, Cheshire, and Hants 1 each. Up to 3rd January there have been 14 outbreaks, but all in previously infected areas."

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MINERAL CONTENT OF PASTURES.

PROGRESS OF THE NEW ZEALAND INVESTIGATION.

(Continued.)

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THE first article of this series gave the results of analyses of certain red-clover samples taken from differing types of pumice sands and loams in Rotorua County (see last month's *Journal*, p. 22). In the present article the samples of white clovers and cocksfoots taken from the same lands are given. In order to save space and to enable the results to be seen at a glance the figures have been averaged, and the averages given in the first article for red clovers are assembled and repeated.

WHITE CLOVERS.

In white clover there is no tendency to produce a woody stem, and one would expect in this species less variation in the chemical composition due to the stage of growth than would occur in the other species (red clover) or in the grass (cocksfoot). There is, however, greater difficulty in securing samples of white clover free from earthy contamination, due to the lower-growing habit of the plant, than is the case with the taller-growing red clover. Some analyses of samples from external soil provinces are inserted for comparison.

The analyses do not show that there is any considerable increase in the phosphoric-acid content due to artificial manuring with phosphates, but this may be owing to the meagre amount of manuring practised in the district under review. In the case of calcium oxide (lime) there appear to be important differences. In the samples from external loams (Gisborne) the lime content is higher than is usually found in the Rotorua lands, and in the case of the Himitangi land, which is very low in phosphoric acid and high in calcium carbonate, the white clover shows a similar correspondence in its content of those constituents. The Gisborne and Otago Central (Ranfurly) lands may be reckoned as naturally among the richest in New Zealand, and the samples from these districts are high in phosphoric acid and calcium.

As shown in the previous article, the amount of iron found in the samples from the coarser types of soil — the fine gravelly sand of Kaharoa and the coarse sand of Ngongotaha — is much lower than in

the samples collected from the finer soils—the sandy loam of Oturoa and the calcareous sandy loam of Te Ngae. Generally speaking, the amounts of phosphoric acid are similar in samples from all types of soils, but the calcium content varies more widely. The results of analyses have again been classified under the headings of "contaminated" and "uncontaminated" samples.

There appears to be this anomaly in the analysis of pasture plants from the Rotorua and adjoining counties: that although the lakeside paddocks at Ngongotaha, which are a recognized sanatorium for bush-sick stock, are composed of coarse sandy soils, they are looked upon as absolutely healthy for stock, and there is no reason to doubt this local tradition. The iron, phosphoric acid, and calcium contents of the pasture plants are apparently little different from those of the most unhealthy country. There is one element, however, which appears to be present in abnormally high amount in the lakeside pastures, and that is manganese. The writer drew attention to the possible influence of manganese compounds on plant-life in 1912 (this *Journal*, Vol. 5, p. 123), and wrote: "The effect of manganese compounds on plant-life is one of the puzzles of agricultural chemistry. Analyses of the affected soils and grass from them have shown that manganese is present in amounts greater than in ordinary soils and grasses. It may be detected in aqueous extract of the soil filtered through porcelain and in citric-acid extracts ('available plant food') of pumice soils in very variable amounts." Manganese—there is ample evidence from other countries—may be either injurious or beneficial to the growth of plants. In the case of the unhealthy pumice lands it may be positively beneficial.

Thus in the white-clover and cocksfoot samples analysed the averages for manganese and iron are as follows:—

White Clovers.

	Mn_3O_4.	Fe_2O_3.		Mn_3O_4.	Fe_2O_3.
Ngongotaha (lakeside only)	0·020	0·010	Oturoa	0·015	0·017
Te Ngae	0·009	0·017	Kapakapa	0·011	0·012

NOTE.—Of these, the Te Ngae, Oturoa, and Ngongotaha lakeside lands are undoubtedly free from the trouble, and Kapakapa is the most "bush sick" of all lands.

Cocksfoots.

	Mn_3O_4.	Fe_2O_3.		Mn_3O_4.	Fe_2O_3.
Ngongotaha (lakeside only)	0·057	0·014	Oturoa	0·028	0·017
Te Ngae	0·021	0·017	Kaharoa	0·048	0·014
External lands—			Mamaku	0·034	0·014
Karori	0·015	0·029	Kapakapa	0·030	0·013
Te Kauwhata ..	0·027	0·034			

NOTE.—Te Kauwhata soil contains much maganese.

In the red clovers from the lakeside there are only contaminated samples, but an inspection of the figures will show that they tend in the same directions as do those of the uncontaminated samples of white clover and cocksfoot. It therefore appears that the manganese by its action in the digestive tract may be enabling the small amount of iron in the pasture to be economized by the animal. With this exception, it would appear that, as with the red clovers, the healthier the land the more iron there is to be found in the white clover growing upon it.

Table 3.—Analyses of Red Clovers (averaged).

The figures are percentages on the material dried to constant weight on water bath.

Number of Samples averaged.	Ash.	CO_2.	SiO_2.	Fe_2O_3.	P_2O_5.	CaO.	MgO.	Mn_3O_4.	N.	Al_2O_3.	Type of Soil.	Locality.
							Uncontaminated and Unmanured.					
7	9·40	1·97	0·11	0·011	0·63	1·92	0·70	0·012	3·43	0·020	Sandy silt and coarser	Mamaku, Kaharoa, Ngongotaha Mountain.
3	8·90	1·77	0·18	0·016	0·73	1·99	0·75	0·008	3·98	0·025	Coarse sand ..	Ngongotaha streamside.
1	10·69	1·84	0·21	0·021	0·88	2·01	0·70	0·012	4·74	0·030	Calcareous sandy loam	Te Ngae Road.
4	9·68	1·66	0·15	0·014	0·74	1·76	0·59	0·015	2·96	0·022	Sandy loam ..	Oturoa.
							Uncontaminated and Manured.					
3	10·21	..	0·13	0·024	0·81	2·62	0·82	0·014	4·56	0·033	Sandy silt	Mamaku.
2	..	..	0·16	0·013	0·83	1·97	..	0·016	..	..	..	Reporoa.
1	10·09	..	0·16	0·017	0·79	2·06	..	0·009	..	0·029	Silt loam	Turakina.
							Contaminated and Unmanured.					
3	9·22	1·21	0·51	0·024	0·79	1·37	0·93	0·016	..	0·042	Fine gravelly sand ..	Kaharoa and Kapakapa.
7	9·56	1·63	0·25	0·016	0·81	1·70	0·57	0·015	4·23	0·051	Sandy silt	Mamaku.
3	10·31	..	0·42	0·019	0·87	1·71	0·80	0·033	..	0·036	Coarse sand ..	Ngongotaha lakeside.
3	10·49	1·85	0·52	0·027	0·77	2·05	0·67	0·015	..	..	Calcareous sandy loam	Te Ngae Road.
2	12·08	2·69	0·18	0·019	0·68	2·35	0·74	0·017	..	0·044	Sandy loam ..	Oturoa.

Table 4.—Analyses of White Clovers (averaged).

The figures are percentages on the material dried to constant weight on water bath.

Number of Samples averaged.	Ash.	CO_2.	SiO_2.	Fe_2O_3.	P_2O_5.	CaO.	MgO.	Mn_3O_4.	N.	Fusion Al_2O_3.	Al_2O_3.	Type of Soil.	Locality.
							Uncontaminated and Unmanured.						
3	8·78	1·50	0·16	0·012	0·78	1·98	0·54	0·011	4·26	0·017	..	Fine gravelly sand ..	Kapakapa Road, Kaharoa.
4	10·94	1·99	0·21	0·017	0·69	1·66	0·60	0·009	4·15	..	0·021	Calcareous sandy loam	Te Ngae.
5	10·19	1·79	0·23	0·017	0·85	1·75	0·50	0·015	..	..	0·021	Sandy loam ..	Oturoa.
2	8·72	1·28	0·19	0·010	0·80	1·30	0·62	0·020	..	..	..	Coarse sand ..	Ngongotaha lakeside.
							Uncontaminated and Manured.						
4	9·49	1·29	0·15	0·018	1·09	2·06	0·52	0·019	..	0·013	0·026	Sandy silt	Mamaku Demonstration Farm.
3	9·75	..	0·22	0·021	0·85	1·77	0·66	0·013	..	0·013	..	Sandy silt	Rotorua and Ngongotaha.
							Contaminated and Manured.						
7	9·97	1·25	0·37	0·026	0·93	1·80	0·51	0·010	..	0·045	..	Various pumice types	Oturoa, Rotoma, Mamaku, Rotorua, Kaingaroa Plains, Ngongotaha.
3	9·48	1·01	0·36	0·028	1·10	1·50	0·67	0·014	..	..	0·046	Sandy	Omanawa.
3	11·38	1·70	0·39	0·033	0·77	1·86	0·60	..	..	0·045	..	Calcareous sandy loam	Te Ngae.
4	11·08	1·47	0·41	0·034	0·86	1·52	0·73	0·009	..	0·034	..	..	Pahiatua and Turakina (external samples).
							Contaminated and Unmanured.						
8	10·76	1·77	0·31	0·028	0·84	1·88	0·64	0·030	4·25	0·028	0·051	Coarse sand ..	Ngongotaha.
3	9·38	1·49	0·29	0·020	0·76	1·71	0·50	0·016	..	0·051	..	Sandy loam ..	Oturoa.
6	11·01	1·56	0·27	0·029	1·01	1·90	0·57	0·018	..	0·036	..	Sandy silt	Mamaku.
4	10·15	1·41	0·45	0·027	0·96	1·57	0·67	0·009	..	..	0·057	..	Te Ngae and Wairoa.
6	9·98	1·43	0·30	0·019	0·91	1·90	0·61	0·011	..	0·025	..	Fine gravelly sand ..	Kapakapa Road, Kaharoa, and Te Pu.
2	12·18	1·65	0·43	0·028	1·05	2·26	0·52	0·020	..	0·033	..	Loam	Gisborne. } External samples.
2	..	..	0·86	0·032	1·03	2·01	..	..	..	..	0·072	Silt	Ranfurly. } External samples.
8	10·98	1·55	0·53	0·057	0·91	1·68	0·61	0·006	3·36	0·072	0·133	Loam	Karori. } External samples.
1	12·15	1·88	0·33	0·037	0·89	1·64	0·59	0·009	4·29	..	0·034	Sandy loam ..	Ohakune. } External samples.
1	9·22	1·54	0·19	0·020	0·61	2·20	0·58	0·012	..	0·005	0·041	Dune coarse sand ..	Himitangi.* } External samples.

* Uncontaminated sample.

The small amount of improvement in the phosphate content of the white clover manured with phosphate is a matter which calls for attention. It may be that the grasses are the pasture components which are more extensively altered in their mineral content by manuring, and that the clovers are always of fairly uniform composition in this respect. The matter will be more suitably discussed when the analyses of the cocksfoot samples are considered.

It will be observed that as yet no attempt has been made to lay down definite standards to distinguish contaminated from uncontaminated samples, and the writer considers it unwise to fix such standards until the results of a larger number of samples have been accumulated over more than one season, and, if possible, from a series of soil types and soil provinces. At present each sample is judged on its merits.

The amount of silica will certainly need to be determined separately for the grasses and for the clovers, as there is no doubt that this constituent is taken up in greatly differing amounts under normal conditions by the two families *Gramineæ* and *Leguminosæ*. With regard to alumina, this may also be taken up in very different amounts by these two families. In water cultures McLean and Gilbert (*Soil Science*, Sept., 1927, Vol. 24, p. 163) found that rye-plants absorbed 0·05 per cent. aluminium, which is equivalent to 0·95 per cent. aluminium oxide (Al_2O_3). This is possibly higher than usual, as the cocksfoots grown in soil (not water), which are considered uncontaminated in these articles, have not a higher alumina content than 0·05 per cent. Al_2O_3 approximately. Stoklasa considers that plants in moist places absorb aluminium more freely than do plants ordinarily. This authority found 0·01 per cent. Al_2O_3 in the above-ground portion of cocksfoot in dry situations and 0·016 per cent. in wet situations (*Jour. Agric. Science*, Vol. 16, p. 337).

Some work of McCarrison (*Ind. Jour. Med. Research*, No. 14, 1927, p. 641) opens up a new field for investigation. It appears that rats fed on rice and wheat, when an *ad libitum* basal diet was also given, showed differences which were in part attributed to the greater manganese content of the wheat, which contained an amount four times greater than that of the rice. This was tested by adding manganese to the rations. The conclusion appears to be justified that concentrations of manganese of the higher order (1 in 12,600 of food) were harmful to the animal organism, while concentrations of the lower order (1 in 617,700) were beneficial ; and since a diet containing a fair proportion of whole wheat provides a concentration of the lower order, it may be concluded that the growth-promoting properties of whole wheat are in part due to the content of manganese in this cereal.*

There are now several biochemists studying the influence of manganese in the diet on animal-growth, and it affords a most fascinating field for study.

COCKSFOOTS.

The great difference in the chemical composition of the ash of grasses compared with clovers is now seen to be the silica content, which is very high in the grasses, and almost absent in the clovers,

* A possible explanation of the fact that in the feeding of penned fowls wheat cannot be substituted by many other obtainable foods may be the beneficial influence of manganese in the wheat.

Table 5.—Analyses of Cocksfoots (averaged).

The figures are percentages on the material dried to constant weight on water bath.

Number of Samples averaged.	Ash.	SiO_2.	Fe_2O_3.	P_2O_5.	CaO.	MgO.	Mn_3O_4.	N.	Fusion Al_2O_3.	Al_2O_3.	Type of Soil.	Locality.
						Uncontaminated and Unmanured.						
8	10·72	2·55	0·014	0·46	0·50	0·43	0·034	..	..	0·043	Fine gravelly sand ..	Te Pu, Kaharoa, Kapakapa.
11	10·27	2·26	0·014	0·50	0·46	0·40	0·034	..	..	..	Sandy silt	Mamaku.
3	10·90	2·36	0·014	0·65	0·44	0·41	0·042	..	..	..	Coarse sand ..	Ngongotaha lakeside and streamside.
7	11·30	2·91	0·019	0·61	0·52	0·53	0·028	..	..	..	Sandy loam ..	Oturoa.
6	10·83	3·42	0·017	0·53	0·43	..	0·021	..	0·030	0·019	Calcareous sandy loam	Te Ngae Road.
1	10·88	3·00	0·034	..	0·38	0·42	0·027	..	..	..	Clay loam ..	Te Kauwhata } External districts.
3	10·74	1·82	0·029	0·70	0·40	0·48	0·015	..	0·028	0·034	Loam	Karori
						Uncontaminated and Manured.						
10	11·12	2·59	0·020	0·87	0·64	0·46	0·031	..	..	..	Various pumice soils	Omanawa, Kaharoa, Rotorua.
						Contaminated and Unmanured.						
1	13·16	5·30	0·042	0·44	0·46	..	0·016	..	0·027	0·061	Calcareous sandy loam	Te Ngae (washed).
1	13·54	5·40	0·046	0·47	0·41	..	0·017	..	0·145	0·095	Calcareous sandy loam	Te Ngae (same sample as above, but not washed).
4	10·39	2·94	0·012	0·50	0·33	..	0·026	..	..	..	Sandy silt	Tauranga and Omanawa.
2	12·15	2·53	0·021	0·87	0·73	0·46	0·023	..	0·052	0·082	Sandy silt and coarser	Mamaku and Kapakapa Road.
5	10·90	3·26	0·017	0·62	0·62	0·41	0·027	..	..	..	Coarse sand ..	Ngongotaha lakeside and Mokoia Island.
4	12·90	3·16	0·017	0·50	0·80	0·44	..	..	..	..	Calcareous sandy loam	Te Ngae.
1	14·50	3·04	0·074	1·13	0·47	..	0·023	..	0·045	0·122	Loam	Karori (external district).

NOTE.—In the case of the cocksfoots the residue of the ash, insoluble in hydrochloric acid, has been fused with sodic carbonate to obtain the silica in the pure state.

—*Analyses by B. C. Aston and I. Cunningham.*

except when present as an earthy contamination. There is also the difference that there is much less phosphoric acid and lime in a grass than in a clover. This refers to the immature plant as eaten by stock from unmanured land. The average phosphoric acid in the cocksfoot samples from the pumice soil-province unmanured lands is from 0·46 to 0·65 per cent., whereas in paddocks top-dressed with phosphate the average phosphoric acid content of the samples is 0·87 per cent.

This seems to indicate that greater change in the composition of the grass than in that of the clover of a pasture is effected by manuring. As with the clovers, the iron content of the samples is always greater, with one exception, on the healthy than on the unhealthy land.

The outstanding results of the analyses of fodder plants from the pumice lands is that the percentage of iron in the plants is always much lower on the unmanured lands than on similar lands from the external districts, where the plants are not growing on soils recently derived from rhyolite. In the case of silica, uncontaminated samples seem to be higher in this constituent than plants growing in non-pumice soils.

SUMMARY.

There seems to be a very large area of country producing in the untreated pasture red and white clover and cocksfoot-grass having a very low iron content compared with outside country on soil not recently derived from rhyolite. This information is gained from practical experience of samples collected and analysed from the respective districts. The literature which is available, and which gives analyses of the plant staples mentioned grown in other countries, also supports the contention of abnormally low iron content of the pumice-land pasture staples. In comparing the analyses of the samples from healthy and unhealthy country in Rotorua County from land not artificially dressed with fertilizers, only one exception is found to the rule that the high iron content is found in healthier country and low iron content in unhealthier country. In regard to this exception it

Table 6.—Pasture Staples in Order of Freedom from Deficiency Disease.

Type of Soil.	Red Clovers.		White Clovers.		Cocksfoots.	
	Number of Samples.	Fe_2O_3. (P.p.M.).	Number of Samples.	Fe_2O_3 (P.p.M.).	Number of Samples.	Fe_2O_3 (P.p.M.).
Fine gravelly sand, unhealthy for all ruminant stock	7	110	3	120	8	140
Sandy silt, unhealthy for all ruminant stock	..	..	..	..	11	140
Sandy loam, healthy for cattle after top-dressing	4	140	5	170	7	190
Coarse sand, healthy without top-dressing*	3	160	2	100	3	140
Calcareous sandy loam, perfectly healthy for sheep and cattle	1	210	4	170	6	170
External district loams, quite healthy	..	..	1	200	3	290
External district loams, quite healthy	..	..	..	..	1	340

* Position anomalous, see explanation.

is suggested that some secondary influence, probably manganese, is rendering the herbage healthy.

In Table 6 the three staples are arranged according to the localities whence they came, in the order of relative freedom from deficiency disease (iron-starvation), beginning with the least healthy and ending with the most healthy. In order to avoid decimals the results (averages) are stated in parts per million. In the cases both of the white clovers and the cocksfoots there is ample evidence that from artificial manuring with phosphate alone, and with phosphate and iron, the iron content of the plants has been greatly increased.

(To be continued.)

THE FEEDING OF LIVE-STOCK.

J. McLINDEN, M.R.C.V.S., N.D.A., Officer in Charge, Animal Husbandry Branch, Live-stock Division.

II. UTILIZATION OF NUTRIENTS.

A GREAT number of complex processes are involved in the nutrition of stock during the assimilation of the foodstuffs digested by the animal. These processes will be dealt with here under two heads—maintenance and production. By maintenance is meant the keeping of an animal on a constant plane—neither gaining nor losing, but simply replacing tissues which have been used or depleted. By production, on the other hand, is meant work, fattening, growth of frame, milk-yield, wool, and so on. These definitions may not be scientifically accurate, but from the practical standpoint of animal-feeding they define the two heads completely.

FATTENING.

Fattening is an easily recognized process, being merely the conversion of farm food-products into fat. So far as the dairy-farmer is concerned, this process applies more to pigs than to the dairy stock. But the dairy stock should be brought up into good condition before calving. If this is done the cow has every chance of doing well, and if she should be of a deep-milking strain she will utilize her condition and even more, for she will even draw on her body reserves. This is a peculiarity of the dairy cow which cannot be overlooked—the fact that she will produce milk although she is not being fed sufficiently, doing so at the expense of her own body.

Fattening may take place at any age, especially if the foods be of a fattening nature and fed in liberal amounts. It goes on most rapidly after maturity, when there is a greater surplus of food materials available after the maintenance requirements of the body have been met. Fattening, therefore, in the main is determined by the amount of food which the animal can digest in excess of that required for growth and production, such as milk or wool.

GROWTH.

The importance of growth is not always well realized. It is one of the most essential points in animal husbandry to feed the young stock well, and allow them to develop. Too many failures in the dairy herd can be attributed to this cause, the young animals being poorly fed while in their youth—say, up to the end of their first lactation. In the case of pigs this often occurs after weaning until fattening commences. Heifers in calf especially must be well fed, for they are growing themselves and developing a fœtus at the same time, and when the calf is born they are milking. These functions cause a very severe strain, and must therefore be supported by liberal feeding. It is impossible for heifers and young cows to grow and produce milk on a small food-supply, and it is no economy to stint them at this age. Certainly one sometimes finds very good milkers which were not well fed in their youth, but their output is at the expense of growth. If they had been properly developed they would have been deeper and more economical producers. An inherent ability to milk will always show.

Growth takes place from birth to maturity, and consists essentially in an increase in the protein tissues of the body and the bone-structure. Developing at the same time is an accumulation of body-fat, which will vary according to the type of food eaten. Flesh-production may be modified by food to a limited extent, but it appears to be mainly a function of the animal, being determined by breed and individuality. Growth is most active in the young, and diminishes as the animal grows older, until at maturity it practically ceases.

FŒTAL DEVELOPMENT.

The exact food requirements of pregnant stock are not known. But if the mother is not well fed she will nourish the fœtus at the expense of her own body. This will reflect adversely, of course, on her milk-supply—resulting, with pigs, in a poor litter at weaning-time, and, with the dairy cow, in poor production.

MILK-PRODUCTION.

By this is meant the production of the dairy cow for the food supplied to her. It is not sufficient to merely maintain her; it is from the extra food eaten that the returns of the farm are going to come. Specially important is it that food be given in accordance with production. There is no more efficient converter of food into milk than a deep-milking cow. Milk-production gives the greatest returns in value from an economical point of view. Why it should be so—the physiological reason—is not yet known, but the fact remains. It is easy to understand why nature makes milk-production an economical process, but it is difficult to know how it is done.

The principal factors which influence the amount and quality of a cow's milk are breed, individuality, age, frequency of milking, condition, excitement, climatic conditions, and the amount and kind of food. Only a few remarks are required to explain these factors, but two will be taken—namely, condition, and the amount and kind of food. The physical conditions as mentioned influence the

quality and quantity of the secretion of cow's milk. An animal in good condition will give more milk, and of better quality, than an animal in poor condition. It has been shown that cows in good condition after parturition will give richer milk throughout the lactation than those which are in poor condition at its commencement.

Influence of Food on Quality of Milk.

Until quite recently the general opinion of the majority of dairy-farmers was that the feed influenced the quality of the secretion. This is not so. Provided the cow receives sufficient food to maintain her weight, no increase of food will influence the quality of her milk. No single food or combination of foods can alter quality if, to start with, the animal is receiving sufficient to meet her requirements. Certainly, if underfed cows are given a liberal ration they will respond to such treatment; the ration, if carrying a liberal supply of protein, will stimulate any cow to the maximum of productivity. But no amount of feeding, however rich and liberal, will alter the composition of, say, Friesian-breed milk to that of Jersey milk in test. This, of course, does not mean total butterfat, but butterfat percentage.

Influence on Quantity of Milk.

The food consumed influences very markedly the quantity of milk secreted by a cow. The food is the all-important factor in the management of the dairy cow, and it is the dairy-farmer's business to provide her with the quantity and quality she requires so that he will receive her maximum production. Heavy eaters of dairy type are those which give the largest yields most economically. In a test which was made the heavy producers returned 52 per cent. over cost of production, while the poor producers returned only 20 per cent.

Great variations, it will be realized, arise in individuals in the matter of economical use of food, but the phenomenon previously alluded to holds good. Any cow, of no matter what dairy breed, will produce milk even although she is not being supplied with the necessary food. This point has already been stressed and is here repeated, for it would seem to be ignored, or possibly not sufficiently recognized, by farmers who do not pay sufficient attention to subsidiary feeding during the periods of poor grazing. If a cow produces at the expense of her own body, this loss must be replaced at once if possible, but the endeavour should be never to let the loss occur at all. If the cow does suffer in condition through a heavy lactation and it is not possible to guard against it at the time, then judicious and heavy feeding should be practised when supplementary crops are available.

Experience is going to show that these depletions, due to deep milking, are a very important causative factor in the many ailments now affecting our dairy herds. The necessary feeding does not mean only those substances already described as the protein, carbohydrates, and fats, but also the minerals, such as calcium, phosphorus, and potash. Just as these are essential to the pasture—as experience has taught—so are they essential to live-stock. Investigators, for instance, now find that as the calcium content of the blood is reduced the incidence of milk-fever increases, and *vice versa*. The heavy-milking dairy cow must have complete and sufficient feeding.

Again, how often is it told that a certain sow is an extremely fine mother because her litter pulls her down extremely in condition. But if this can be regarded as proof of her quality it certainly can be taken as proof of the owner's inability to realize his duty to such a sow. Where litters are taken off the breeding-sow once a year the damage done by such management will not be so readily detected, but where the breeding is done twice yearly it very soon results in small litters, too high a percentage of deaths before weaning, and sterility in the sow. If strong healthy piglings are to be weaned regularly, then the sow must be well treated and kept in good breeding condition, neither too fat nor too thin. This means liberal feeding and a plentiful supply of good drinking-water, together with room for plenty of exercise.

VALUE OF NUTRIENTS.

It is essential, before proceeding further, to discuss some standard whereby the values of the nutritive materials in a food may be compared.

Digestibility: It is common knowledge that all the food consumed by stock is not utilized by them for sustenance and production. As the food passes through the digestive tract a certain portion of it is prepared by the animal for assimilation. That is known as the digestible portion, and is chiefly composed of digestible protein, carbohydrate, and fat. It is this portion which is of feeding and producing value to the animal fed; and when considering the food eaten by an animal it is the digestible portion which most concerns the farmer. Each type of food used is generally digested in similar quantities within close limits. For convenience this quantity digested for each particular food is referred to as the "coefficient of digestibility." So far as average farm crops are concerned, no great differences exist in the digestibility of the respective foods.

Digestible carbohydrate equivalent: The energy-giving portion of a ration has been described already as the carbohydrates and the fats. For convenience these two substances have been grouped together, and allowance made for the fat to contain two to three times as much energy as a similar quantity of starchy matter. This is calculated, of course, on the digestibility of the carbohydrates.

Total digestible nutrients: The meaning of this term should be obvious. It is the value of the digestible protein when added to the digestible carbohydrate equivalent.

Nutritive ratio: At one time this term held great significance. When rations were being compiled of concentrated foods it was regarded as essential for proper nutrition that the nutritive ratio should be a definite thing. This nutritive ratio means the knowledge of the relation of the digestible crude protein to the digestible non-protein constituents in the diet (digestible carbohydrate equivalent). As the quantity of digestible non-protein becomes greater in proportion to the digestible protein the ration is said to become "wider," and as it lessens the ration becomes "narrower." This is really suitable for the classification of feeding-stuffs; but otherwise, as an index as to the suitability of a ration being adequate to the needs of an animal for a specific purpose, experience has emphasized what was originally felt to be a weakness. At the present day the nutritive ratio of a diet

does not hold the significance which at first it was expected to hold. Better and more suitable guides have been adopted through a better knowledge and understanding of animal nutrition.

REQUIREMENTS OF STOCK.

It is important to know the composition of a food and how much of that food is digestible, but it is just as essential to know what the live-stock require for milk, beef, or pork production. In those countries where natural conditions compel the stock to be fed on substances other than grass, hay, and grain and root crops this knowledge of the composition of foods becomes very necessary, for the subsidiary foods used are generally very expensive, and economy must be practised. But, again, in countries like New Zealand, where it may be said that stock depend wholly on the foods grown on the farm, such knowledge is also very essential from another point of view. Dairy cows require foods which will supply them with an adequate amount of protein if they are to produce their maximum. Heavy production means that greater quantities of mineral matter must be supplied, or the cow will suffer in health. As for the carbohydrate portion, there is little fear of the cow fed on home-grown foods not receiving enough; but this, unfortunately, cannot be said with regard to the amount of protein fed and also the amount of mineral supplied. Further, there is an important fact also to be contended with. If the amount of carbohydrates fed should be too much in comparison with the amount of protein (a very likely thing with home-grown crops), then the value of the protein is reduced because it is not digested to the same extent In other words, excess of starchy foods reduces the digestibility of the protein portion of the diet. The converse — a liberal supply of protein — increases digestibility of all the diet. This factor is referred to as the "balance of nutrients." It not only includes the digestible protein and digestible carbohydrate equivalent, but also the ash or mineral portion, the vitamins, and what is described as the "quality" of the protein. Quality in this connection refers to the suitability of a protein for maintaining health.

Although the different organic constituents can to a very great extent be substituted one for another, protein is absolutely essential for the development of the fœtus and milk-production. For such purposes an average amount of protein is shown experimentally to be required. But the figures to be given for the purpose of the ration must be regarded as an average, and do not represent the maximum to be supplied. With milk-production especially it should be, if anything, exceeded, for protein has the effect of stimulating metabolism generally and milk-production especially. As the substance increases the cost of a food, it must be used with care and not fed too lavishly, or the cost of feeding would defeat the object.

All the known feeding-standards in use at the present day only take into account the two chief types of organic food, and no attention is paid to the mineral constituents and other accessory factors. The real reason for this is that our knowledge of these other requirements is still at the investigation stage, and not sufficient is known of them yet to permit of detailed requirements being stated. What is known is that the dairy cow must receive a full

supply of nutrients if a prolonged and heavy production is required. If this is not supplied, it results in depletion of her own body, resulting in her milking only for a comparatively short period after calving. With pigs it results in their not thriving at the necessary rate consistent with economy in production. A pig of slowly attained maturity is an economic loss. Time must be reduced to a minimum in the production of pork and bacon. What these necessary requirements are for the different kinds of animals, especially milking-cows, is hard to define, because they vary with age, size, production, &c.

It will be quite readily understood why the ration for a milking-heifer will vary from that for an adult cow. The milking-heifer is not only producing milk but she is still growing, therefore she will require a more liberal protein and mineral supply.

The influence of size of the animal on the ration is difficult to explain, but experiment has shown that relatively the smaller animal requires more protein than the larger one.

The effect of condition on the maintenance ration of a cow does not require much explanation. If two animals are compared—one in good and the other in poor condition—more nutriment for a given weight will be required for the animal in good condition than for the poor one, especially as regards protein. The poor animal can be maintained on a cheaper diet on a maintenance ration.

At the present day it does not pay to keep animals in poor condition, for their production suffers too severely. Such dairy cows cannot keep up production, and if pigs are allowed to remain poor they cannot be economically fattened. Under present conditions pigs must be kept advancing every day from birth till the time they are killed. Failure in this respect is probably the greatest source of lack of success in swine husbandry.

NEW ZEALAND NATURAL CONDITIONS.

The New Zealand farmer is fortunate in one very important respect so far as dairy cows are concerned, and that is in the possession of natural conditions making normally for a great supply of succulent food. These foods have a very good effect on dairy cows, and are essential to economic production. They are a very palatable type of food, laxative in nature, have bulk, and provide water, which is so necessary to dairy cows of deep-milking qualities.

Good pasture-grass is the best succulent food for dairy cows, and in late spring and early summer will provide all such feeding they require. For the later part of summer and in autumn it may be necessary in certain areas to grow auxiliary forage crops or use silage, while in winter-time roots and silage provide the requirement. This type of food should always form part of a dairy cow's ration, for she always does better when the ration is laxative in nature. Here, again, is why hay when used should contain a plentiful proportion of clover.

When feeding green foods care must be taken with turnips, kale, silage, and the like, otherwise the milk will be tainted. It is much easier to taint the milk than to remove such flavours from it. Such foods should only be allowed after milking.

(To be continued.)

FLESH-COLLAPSE IN STURMER APPLES.

COOL-STORAGE EXPERIMENTS, 1927.

R. WATERS, Plant Pathologist, Biological Laboratory, Wellington.

AMONG the fruit-storage problems presented from various parts of New Zealand is a trouble occurring in Sturmer Pippins and certain other apple varieties. Here and abroad it is recognized as a functional disease —one liable to occasion much damage to the stored fruit. Here it is more prevalent in certain lines and stores, and is commonly diagnosed as flesh-collapse or internal breakdown. The study of the disease commenced in Nelson in 1920, and last year was pursued in Hawke's Bay and Auckland, using fruit from three selected orchards. These orchards represented a group, the Sturmers from which—in certain stores—had previously developed flesh-collapse abundantly. The three lines were studied in six different cool stores under usual and under modified commercial conditions. While this procedure has special merits, it may not make for the same scientific accuracy and proof as that obtainable in a laboratory equipped for fundamental research, with smaller quantities at stake and with more precisely controlled and recorded conditions.

INFLUENCE OF DIFFERENT STORAGE CONDITIONS.

Last year's work showed how one set of storage conditions compared with another may influence the onset and intensity of flesh-collapse. In three of the stores traces of the disease were found as early as August—that is, after four months' storage. In the three unaffected stores, moreover, there was still no appearance of flesh-collapse in October—after six months' storage. The position is set out in the following table:—

Table 1.—Comparison of the Three Experimental Lines in respect to Damage suffered from Flesh-collapse after Six Months' Storage.

Store.	Line.	Number of Apples examined.	Unaffected.	Intensity of Flesh-collapse. Barely damaged.	Slightly damaged.	Badly damaged.	Very badly damaged.	Total damaged.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
F ..	RX	50	100	..	..	..	..	..
	RB	51	100	..	..	..	..	..
E ..	BX	100	100	..	..	..	..	..
B ..	RX	100	49	31	12	7	1	51
	BX	100	90	10	..	..	..	10
	RB	100	90	7	2	1	..	10
C ..	RX	108	100	..	..	..	..	..
	BX	126	100	..	..	..	..	..
	RB	100	100	..	..	..	..	..
A ..	RX	100	97	3	..	..	..	3
	BX	100	95	5	..	..	..	5
	RB	100	99	1	..	..	..	1
D .	RX	0	..	..	..	..	..	..
	RB	0	..	..	..	..	..	..

These results, coupled with the examinations made from time to time of the stocks of the unaffected stores, demonstrate in a general manner a matter of the first importance in this investigation—namely, that the prevention of extensive damage from collapse to relatively "susceptible" lines in cool stores is possible and practicable for at least six months.

The next examination was made in October—after about eight months' storage. The bulk of stored apples in New Zealand is unloaded by this time, and there remains a comparatively small proportion consisting of long-storage varieties—among which are Sturmers—that may require to be held a few weeks longer. Table 2 shows that these selected Sturmer lines were all affected to some extent in all the stores after eight months, the intensity of the disease being much greater in one store than in another.

Table 2.—Comparison of the Three Experimental Lines in respect to Damage suffered from Flesh-collapse after Eight Months' Storage.

Store.	Line.	Number of Apples examined.	Unaffected.	Intensity of Flesh-collapse.				Total damaged.
				Barely damaged.	Slightly damaged.	Badly damaged.	Very badly damaged.	
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
F ..	RX	500	91	9	..	..	..	9
	RB	461	59	41	..	..	..	41
E ..	BX	433	70	29	1	..	..	30
B ..	RX	366	78	20	1	1	..	22
	BX	266	54	40	4	2	..	46
	RB	416	53	35	9	2	1	47
C ..	RX	244	92	8	..	..	..	8
	BX	186	38	54	8	..	..	62
	RB	332	35	65	..	..	..	65
A ..	RX	231	71	26	3	..	..	29
	BX	287	41	29	15	14	1	59
	RB	384	48	33	17	2	..	52
D ..	RX	233	66	15	13	4	2	34
	RB	385	37	32	28	3	..	63

The figures in this table are liable to convey a worse impression of the condition of each line than is justified. The slightest trace of collapse was recorded. The percentage under the heading "Barely damaged" is that of apples which had suffered little or no commercial damage from collapse. Further remarks on the intensity of the disease are made later.

"SUSCEPTIBILITY" OF DIFFERENT LINES OF THE SAME VARIETY.

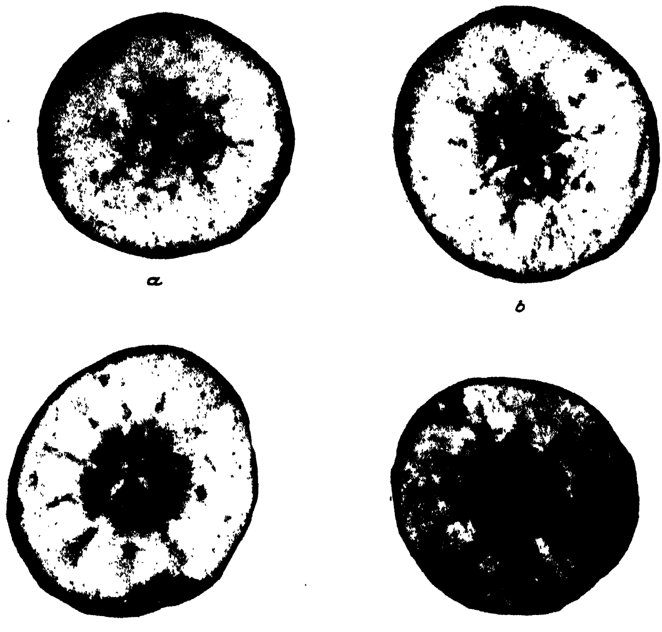
Table 2, which is based on larger counts than Table 1, indicates that while all experimental lines had some collapse by October, two of them —"BX" and "RB"—suffered at least twice as badly as "RX" in all the stores. A marked difference in the "resistance" to collapse of one line compared with others of the same variety is here indicated,

a feature that has been well brought out in former experiments. An analysis is being made of the results to elicit more specific reasons for this difference.

THE IMMEDIATE PROBLEM.

Where flesh-collapse has occurred freely the immediate problem is to provide such storage conditions as will enable lines of moderate "susceptibility" to be held satisfactorily with those more "resistant" of the same varieties. In one store "susceptible" varieties totalling some 17,000 cases were so grouped last year that the prescribed treatment could be given them without interfering with those varieties storing well under customary conditions. The initial separation of the fruit in this way enabled a great improvement to be made in the condition of long-storage varieties, more particularly Sturmers.

The separation of the pip-fruits generally into groups, so that each may subsequently be treated according to its requirements, is a means of improving the health and lengthening the life of the fruit in certain cool stores in New Zealand. Having provided the storage conditions most suitable for each group of fruit, the next problem is to discover the factors which make for "susceptibility." The figures obtained from last year's work promise to add some useful evidence to that already obtained in this direction.



FLESH COLLAPSE IN STURMERS, 1927 EXPERIMENTS.

Showing intensity of the disease—prominently about the core—as it commonly occurred after eight months' cool storage. About half natural size.

(*a*) Barely damaged, (*b*) slightly damaged, (*c*) badly damaged, (*d*) very badly damaged.

[*Photo by H. Drake, Biological Laboratory.*

INTENSITY OF THE DISEASE.

The experimental fruit was brought out of store and held for a week or more before being cut for examination. The disease when present was commonly localized in the pith, a portion of the tissue confined to a small region about the core. Here it frequently occurred merely as a slight discoloration—one to five pinkish or light-brown flushes or patches. Sometimes, however, the colour was darker. Apples externally healthy in appearance and internally showing no discoloration of the cortex or main body of the flesh but only a slight discoloration about the core were classified as "Barely damaged" (Fig. 1*a*). They were such as would be auctioned, retailed, and thereafter consumed without any serious cause for complaint. The term "Slightly damaged" was used when the pith was darkly discoloured, or when the disease was lightly diffused through the flesh (Fig. 1*b*). "Slightly damaged" apples would invariably escape detection until they reached the consumer. The "Badly damaged" and "Very badly damaged" would sometimes show injury externally, and, where repacking is not practised, would be of still greater detriment on the market (Fig. 1 *c* and *d*).

GENERAL.

The 1927 experiments were to some extent duplications or extensions of previous work at Motueka. They disclose further problems of importance in fruit cool storage. The figures obtained are now being examined, and a further presentation of results, supported by such evidence as is available, will later be made in the *Journal*.

Thanks are due to Messrs. N. J. Adamson and W. H. Rice, Orchard Instructors of the Horticulture Division at Hastings and Auckland respectively, for their hearty co-operation—the former more particularly in the work of securing uniformity among the fruit picked and packed for experimental purposes, and the latter in the final examination and classification of the fruit.

(To be continued.)

LOOSE SMUT OF WHEAT ("BLACK-HEADS").

THE fungus which causes this disease is carried over from one crop to the next entirely *within* the seed, so that pickling the seed with bluestones or formalin, which fairly effectively controls stinking-smut (or "ball-smut"), has no effect on loose smut. The only practical way of avoiding loose smut is to use seed which has been harvested from a crop entirely free from "black-heads." Since the spore masses of the fungus (which constitute the "black-heads") appear at flowering-time of the wheat-plant and are all blown away by harvest-time, it is impossible to tell from a sample of threshed grain whether it is infected or not. Until a system of seed-crop certification under proper supervision is instituted in New Zealand a grower is helpless in regard to this disease unless he has personally inspected the crop from which he obtains his seed, soon after it emerges from the shot-blade.—*J. C. Neill, Field Mycologist.*

Mueller Medal for Research.—The General Council of the Australasian Association for the Advancement of Science, meeting this year, has awarded the Mueller Medal to Dr. L. Cockayne, F.R.S., of Wellington, for his researches in New Zealand botany extending over a period of twenty-five years.

REPLACING THE HAWTHORN HEDGE.

W. C. HYDE, Horticulturist, Horticulture Division, Wellington.

HORTICULTURAL industries have for some time past suffered severely from the many diseases harboured by the hawthorn and its related species. The genial climate of New Zealand seems to have had the effect of increasing these difficulties, judging from comparisons with the experience in colder countries. With the advent of the bacterial disease known as fireblight—of which the hawthorn is a common and natural host—the problem has become so serious that the commercial production of apples and pears is impracticable in localities where this disease has become established in the hawthorn. From these conditions has arisen the necessity of getting rid of hawthorn in districts where the production of pome fruits is an industry of sufficient extent to warrant its protection. The extent of hawthorn hedges makes it impossible to cut out all the fireblight cankers with which the plant may be infested—the only means of controlling this disease—and hence its control in the orchard is impossible with annual reinfection, as it is easily and extensively redistributed by birds and insects.

In some instances a wire fence will make a suitable replacement for the hawthorn hedge, but in other cases a shelter-hedge is also required. In response to inquiry on this point the suggestions which follow are made.

Under most farm conditions barberry is no doubt the best stock-proof substitute, particularly if the evergreen seedless variety grown in the Waikato is used. It is well to remember that there are a number of varieties of *Berberis vulgaris*, brought about by the method of propagation by seedlings. Where this method of propagation is adopted great care should be taken to obtain seed from plants of a strong evergreen type. Better still is it to put out plants grown from cuttings of the seedless variety.

Where a tall shelter is required this may be obtained on most alluvial soils by interplanting the barberry with Lombardy poplars at intervals of 2 ft. to 3 ft. Such a shelter is quick-growing and requires a minimum of attention once it is established.

In the warmer districts osage orange (*Maclura aurantiaca*) would doubtless do well. It is a popular stock-proof farm-hedge plant in the middle United States of America. It is a deciduous tree of about the same size and habit as the hawthorn, and requires similar treatment to establish it as a hedge. The leaf is much like that of the pear-tree. It has been grown to some extent in Hawke's Bay, and is not a host of any serious pest, the worst probably being a slight infection of San Jose scale. It will thrive on poor country—in fact, it is rather intractable on good heavy land owing to the vigour of its growth. It is grown from seed, and if the plants are planted close—say, 6 in. apart—and cut back hard for the first two or three seasons to cause branching at the base, it makes a good stock-proof hedge.

For an evergreen one-line shelter on fair to good land Lawson's cypress (*Cupressus Lawsoniana*) is becoming deservedly popular. It is naturally well clothed with foliage at the base, and when planted 3 ft.

FIG. 1. LAWSON CYPRESS SHELTER-HEDGE IN ORCHARD OF W. MONOPOLI, STOKE, NELSON.
Height, 20 ft. to 25 ft.; age, 25 years.

FIG. 2. SHELTER-BELT OF LOMBARDY POPLAR UNDERPLANTED WITH BARBERRY ON FARM OF J. TILBURY, LOWER HUTT.

apart usually runs up to about 10 ft. high, with a tapering top that dispenses with the need of frequent trimming. Of a somewhat similar type is the Douglas fir or Oregon pine (*Pseudotsuga Douglasii*). Both Lawson's cypress and Douglas fir are unusually free from disease, and may be grown on hilly country. On alluvial soils they are sometimes interplanted with Lombardy poplars, which extends the height of the shelter; this extension is, of course, leafless in winter.

On lighter land in rather dry localities the Himalayan cypress (*Cupressus torulosa*) makes a good evergreen shelter-belt. While similar in foliage to the macrocarpa and Roman cypresses, it is more compact than the former, and more vigorous and stouter than the latter. Planted 3 ft. apart, its compact upright growth would take up little room, and require little or no attention in the way of trimming.

On heavy land macrocarpa cypress and pines are usually too vigorous to be recommended for shelter - hedge purposes generally. Under such conditions they are inclined to grow large and coarse, with

FIG. 3. REDUCING 40-FT.-HIGH HAWTHORN HEDGE ON FARM OF M. STAPLES, MOTUEKA.

FIG. 4. REMOVING HAWTHORN HEDGE WITH STUMPING APPLIANCE ON PROPERTY OF S. RAWLINGS, RIWAKA.

bare trunks and an absence of shelter where it is most needed. Such shelter-trees, however, still deserve consideration where a one-line shelter is required on light land or on some classes of hill country. Under such conditions macrocarpa cypress and *Pinus muricata* are rendering efficient service. But in the case of all these conifers it is to be noted they are not stock-proof, and to maintain their efficiency—not merely as shade-trees but as shelter-belts—it is necessary to fence them from stock, otherwise they lose the lower-foliaged branches which form their chief value.

BARLEYS IN MARLBOROUGH.

THE malting barleys of Marlborough afford a very fine practical demonstration of the value of seed-selection as a means of controlling crop disease. Practically the whole of the malting barley grown in the province is under contract to New Zealand Breweries, Ltd., whose Marlborough representative, Mr. H. S. Hewlett, very carefully selects the crops to be used the next season for distribution as seed to the contract growers. The effect of this policy on the incidence of covered-smut of barley—one of the most destructive diseases of barley if left unchecked—can be judged from the following facts. Out of forty-three crops of malting barley examined in the 1926–27 season, twenty-three were smut-infected. This season, out of twenty-one crops sufficiently advanced for its detection, not one showed even a trace of smut. Cape barley, which is not controlled, showed an average of 10 per cent. of covered-smut.

There is another disease of barley, however, for the checking of which, in the present state of our knowledge, little can be done. This is stripe disease. Stripe is difficult to detect unless the attack is severe, and, as severe infection appears only to occur when the crop has been subjected to some unfavourable set of soil or weather conditions, its effects are usually ascribed to this latter cause. Stripe was observed in thirty-four out of forty-five crops examined last season and in seventeen out of twenty-one crops this season. Although until we know more about this disease it is impossible to estimate the loss due to it there can be little doubt that, as it is caused by a seed-borne parasitic fungus, it must be the cause of a certain reduction in quality and yield. Experiments are now in progress to determine the best practical method for its control.

—*J. C. Neill, Field Mycologist.*

Export Butter Weights.—Referring in a recent address to certain complaints from overseas, the Director of the Dairy Division, Mr. W. M. Singleton, stated: "We have been going into this matter of late, and find that when the parchment is stripped from the block of butter it may weigh up to 5 oz. or 6 oz. instead of the original weight of the paper at, say, 4 oz. It would appear reasonable that a retailer should expect a block of butter to weigh at least 56 lb. when stripped. We must have a minimum of 56 lb. 6 oz. to ensure this; and 56 lb. 8 oz., including paper, would probably be the safer weight to aim at placing in the boxes."

Fruit Export Levy.—This season's levy under the Fruit Control Act has been fixed at 1½d. per case.

LIMING AND MANURING OF PASTURE AT WINTON EXPERIMENTAL FARM.

BLOCK 3 RESULTS FOR 1927.

R. McGILLIVRAY, F.L.S., Instructor in Agriculture, Invercargill.

THE fourth year's weighing of plots and general examination of the pasture on Block 3 at Winton Experimental Farm were carried out on 5th December last. The block had been closed up for thirty-three days, and there was a good growth of grass; the weighing was carried out most expeditiously. The pasture was kept under observation throughout the year, and, as far as could be seen, the sheep this season did not differentiate between the basic-slag and Nauru-rock-phosphate plots like they did in previous years; moreover, the Nauru plots were grazed quite as closely as those dressed with slag.

	1·8 Tons Carbonate of Lime. A.	3·6 Tons Carbonate of Lime. B.	No Lime. C.	2 Tons Burnt Lime. D.	1 Ton Burnt Lime. E.	Totals.	
	lb.	lb.	lb.	lb.	lb.	lb.	
Plot 1..	42½ 45	41½ 46	34 35	42 44	42 37	409	Basic slag.
Plot 2..	34 31¼	33¾ 34	33 35	33 34	33 31	332	Control (no manure).
Plot 3..	42 43½	44 46	40 36	45 40	37 35½	409	Basic slag.
Plot 4..	33½ 32½	35½ 33	37 38	39 36½	30 29	344	Control.
Plot 5..	46 42	50 56	41 55	46 45	35 37	453	Basic slag.
Plot 6..	43 43	50 52	45 52	44 44	37 37	447	Nauru phosphate.
Plot 7..	37 35	40 33	36 35	34 36	27 34	347	Control.
Plot 8..	43 47	41 46	44 40	47 46	36 36	426	Nauru phosphate.
Plot 9..	32 33	38 36½	33½ 36	38½ 37	36½ 39	360	Control.
Plot 10..	43 40	40½ 41	43 40	43½ 38	41 37	407	Nauru phosphate.

LAY-OUT OF BLOCK 3, WITH GREEN WEIGHTS OF PLOT CUTTINGS.

The various plots were top-dressed in 1924, 1925, and 1926 at the rate of 3 cwt. per acre, but no top-dressing was done in 1927. The stocking during the year under review was heavy, and the block was considerably enriched with animal-droppings, but the pasture was kept wonderfully clean and made rapid growth during any short period in which it was not stocked. The weighing of plots was done in a similar manner to that recorded in earlier reports, and green weights were taken immediately after the various plots were cut.

The accompanying lay-out diagram of the block gives the green weights of herbage for the plot cuttings in December.

The following table shows the average green weights of the manured and control subdivisions under various lime treatments :—

Table 1.

			lb.
Subdivision	A :	1·8 tons carbonate of lime plus 3 cwt. basic slag..	87·0
,,	B :	3·6 tons carbonate of lime plus 3 cwt. basic slag..	94·5
,,	C :	No lime ; 3 cwt. basic slag	80·3
,,	D :	2 tons burnt lime plus 3 cwt. basic slag	87·3
,,	E :	1 ton burnt lime plus 3 cwt. basic slag	74·5
Subdivision	A :	1·8 tons carbonate of lime plus 3 cwt. Nauru phosphate	80·3
,,	B :	3·6 tons carbonate of lime plus 3 cwt. Nauru phosphate	90·1
,,	C :	No lime ; 3 cwt. Nauru phosphate	88·0
,,	D :	2 tons burnt lime plus 3 cwt. Nauru phosphate	87·5
,,	E :	1 ton burnt lime plus 3 cwt. Nauru phosphate	74·6
Subdivision	A :	1·8 tons carbonate of lime—control	67·0
,,	B :	3·6 tons carbonate of lime—control	70·9
,,	C :	No lime—control	70·8
,,	D :	2 tons burnt lime control	72·0
,,	E :	1 ton burnt lime—control	64·8

The weights per plot under the manurial scheme are shown in the following table :—

Table 2.

	Totals. lb.	Average. lb.
Basic slag—		
Plot 1	400	
Plot 3	409	423·6
Plot 5	453	
Nauru phosphate		
Plot 6	447	
Plot 8	426	426·6
Plot 10	407	
Controls—		
Plot 2	332	
Plot 4	344	345·7
Plot 7	347	
Plot 9	360	

BOTANICAL ANALYSIS.

Representative samples of pasturage were taken from each plot. These were examined while green, and divided into three sections—grasses, clovers, and weeds. These samples were then weighed and dried under cover, and again weighed to ascertain loss in drying. Results of the botanical analysis are given in Table 3 (next page).

The analysis is of considerable interest and importance. It will be noticed that the clover content of the Nauru-phosphate plots is this year (1927) equal to that of the basic-slag plots. In the three preceding yearly examinations the Nauru plots were inferior to the

basic-slag plots both in weight and clover content. It was noticed throughout the past season that the growth of clover in the Nauru plots had improved considerably, and at time of cutting no difference was noticeable in the two sets of plots. In control plots 2, 4, 7, and 9, however, the absence of vigour in the growth of the clover-plants was discernible without any very close examination, and the botanical examination showed that in the controls (no-manure plots) generally the clovers were approximately 50 per cent. less than in the basic-slag and Nauru plots.

Table 3.—Botanical Analysis.

Subdivisions and Plots.	Grasses.	Clovers.	Weeds.	Subdivisions and Plots.	Grasses.	Clovers.	Weeds.
	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.	Per Cent.
A, 1, 3, 5	76·75	16·00	7·25	B, 6, 8, 10	75·70	17·20	7·10
B, 1, 3, 5	75·24	17·81	6·95	C, 6, 8, 10	78·50	12·40	9·10
C, 1, 3, 5	78·80	12·25	8·95	D, 6, 8, 10	75·85	15·15	8·00
D, 1, 3, 5	75·85	16·00	8·15	E, 6, 8, 10	77·01	14·09	8·90
E, 1, 3, 5	76·88	15·20	7·92	C, 2, 4, 7, 9	80·71	9·88	9·41
A, 6, 8, 10	75·75	16·25	8·00				

In previous reports it has been mentioned that the clover content of the pasturage from the burnt-lime plots was not so great as that from the carbonate-of-lime plots. The average clover content this season, as ascertained by analysis, is as follows :—

	Carbonate of Lime. Per Cent.	Burnt Lime. Per Cent.
Basic slag	16·90	15·60
Nauru phosphate	16·72	14·62

When dry weights were compared with green weights it was found that the loss amounted to 34 per cent. in the basic-slag and Nauru plots, while in subdivision C, plots 2, 4, 7, and 9, where neither lime nor phosphate had been applied, the loss in drying amounted to almost 45 per cent. The growth on these plots was not so far advanced as in the other plots, and the greater loss in drying can no doubt be put down to the immature condition of the herbage at time of cutting.

Four years' results are now available from the manurial experiments conducted on Block 3. In the first and second seasons good results were obtained from the use of basic slag, with negligible results from Nauru phosphate. In the third season there was an appreciable improvement generally in the condition of the Nauru plots, and, as will be seen by this report, the Nauru plots have shown a most marked improvement in the fourth year. Thus the indications are that under Southland conditions finely ground Nauru rock phosphate may be considered an efficient factor in pasture-improvement.

Fireblight Regulations.—Amending regulations under the Fireblight Act, 1922, were gazetted on 12th January, and took effect as from that date. They make certain alterations regarding the commercial fruitgrowing districts—Thames and Whangarei in particular.

CONTROL OF TOMATO MILDEW.

TRIALS IN AUCKLAND DISTRICT, SEASON 1927–28.

Introduction.

At the beginning of the present season a request was received by the Horticulture Division from the Auckland Tomato-growers' Association for a demonstration in the control of mildew on tomato-plants grown under glass in that district. It was stated that the trouble commenced about the month of October, and was so severe as to prevent the full crop being brought to maturity. This demonstration was carried out under the supervision of Mr. W. H. Rice, Orchard Instructor for the district, who furnishes the report which follows these introductory notes.

In the Department's bulletin "Tomato-culture," by W. H. Taylor, it is stated, "This disease is caused by a humid atmosphere and high temperature; the remedy is better ventilation." A survey of the glasshouses for tomato crops in the Auckland District showed a strange deficiency in ventilators in these buildings, and obviously without them adequate ventilation cannot be given. The ventilator equipment for a house 14 ft. wide in a cold climate is totally inadequate in a warm climate, especially when the house is widened to 30 ft. or more, and planted close with a tomato crop which in the month of October is more than half full of dense vegetation. Those were found to be the usual conditions in this locality. In a few instances the ventilator equipment was less, and in one instance observed a large house had been built for this purpose without ventilators of any kind. Obviously under such conditions some growers are making unreasonable demands from science in these days, and the sooner the position is realized the better.

Suitable ventilation depends on the number and size of properly placed ventilators. The requirements of this kind to be built into a house depend on the crop which is to be grown, the climate of the locality, and the size of the house. Cucumber-houses built 12 ft. to 14 ft. wide are often erected without any ventilators and work satisfactorily, although even they would be more easily operated with some available ventilation occasionally. The tomato crop, however, requires a dry, buoyant atmosphere especially, which makes the problem of ventilation quite a different one.

The warm humid climate normally prevalent in Auckland is naturally an important factor in the problem also. If in the South Island it is found necessary to have continuous ventilation along *both* sides of the ridge of the tomato glasshouse, in the northern districts one would expect the same, *only wider*. In addition to this the houses generally in the northern districts are wider and often larger in other ways. This may very probably be an economy, but in extending the measurements it should be remembered that the proportion of ventilator area must be correspondingly increased.

Suitable manures and culture, as Mr. Rice shows, increase the resistance of the plants to mildew in some degree, but relief in the main

depends no doubt in reducing the humidity and temperature during the warmer periods in summer by means of a large increase in the ventilator areas available.

—*W. C. Hyde, Horticulturist, Horticulture Division.*

REPORT BY W. H. RICE.

Throughout the Auckland District *Cladosporium fulvum* is much more prevalent on tomatoes under glass than in the colder parts of the Dominion. The disease makes an appearance on the plants towards the middle of October, and from then onward it is a race between the maturing of the larger part of the crop and the disease. Orthodox sprays have been tried in vain, and at present there seems no hope of control in that direction; therefore endeavour is made to have the plants as forward as possible so that the greater part of the crop may be harvested.

In this respect variable results have been obtained, and therefore experiments were undertaken this season and general observations specially made to determine, if possible, what factors in culture disposed the plants to susceptibility or resistance.

The season has been a particularly bad one for Cladosporium. Continual wet weather and overcast conditions during the period of plant-growth (not very favourable for good ventilation) caused a tender growth of plants. As the fruits were swelling and ripening, continued open sunny weather conditions were general, with high day and low night temperatures, causing the disease to rapidly destroy the tender plants, even though well forward. Extra-tender plants harvested a much lesser crop than might have been expected, and the fruit from such plants was soft in texture owing to the absence of foliage. All the plants suffered more or less, but it has been outstanding that not only should the plants be well forward, but they should be well and hardily grown to afford maximum resistance to the disease.

VENTILATION.

The majority of the glasshouses in the Auckland District are poorly ventilated. This causes more tender growth than advisable for tomatoes, and wherever possible it should be remedied. Observations show that the better the ventilation provided and the more freely it is used during the growing-period, the better the plants will resist Cladosporium.

DUSTING.

Comparisons were made with dry flowers of sulphur, Sulpho, and Cloud Form tomato-dust, as against undusted. Cladosporium was prevalent in each instance. Dusting with either of these materials cannot be considered as in any way beneficial. No variation in time of attack or severity could be noticed on any dusted section, which were all as bad as the undusted. The plants were fully defoliated by the disease by the time the crop was ready for picking.

DEFOLIATION AND PINCHING.

The regular practice is to stop plants beyond five bunches, all side shoots having been kept pinched out prior to this. About the time plants are stopped Cladosporium may be expected. To reduce infection

the lower leaves are pruned off as the lower fruits are picked. Observations show that the plants which fail to finish most of their fruits are those on which all top-side laterals are suppressed, while those which are allowed to freely vegetate side shoots after the plants are stopped benefit greatly by this in growth, and more nearly perfect the whole of the crop.

WHITE ISLAND MINERAL PRODUCT.

Used as a soil-dressing prior to planting (300 lb. per acre) and with repeated surface applications after each watering or hoeing (100 lb. per acre) White Island "No. 1 Product" gave promising results as a soil insecticide. No plants were lost from the ravages of insects during establishment, as against a loss of 12 per cent. in untreated land. Slugs, snails, cutworms, grass-grubs, and wood-lice were all controlled. The plants made good establishment, and throughout the whole period of growth were more robust than were those where this product was not used. The favourable growth was characterized by stouter stems, larger leaves, broader and denser foliage with an absence of crinkle at the edge, and firm and more uniform fruits. This favourable growth continued to resist Cladosporium some time after other plants were attacked. Though Cladosporium did finally develop, the crop was better all round and the season extended.

In a section where the White Island product was not applied until some two weeks after planting, the plants did not show any better than the untreated until about 3 ft. high. From then onwards they began to show advantageously, and finally made far better plants than the untreated. So marked was the better development that several growers decided to make late applications general. Some improvement was no doubt due to this, but it is very evident that early applications, at least two weeks prior to planting, give best results, though continued light dressings are favourable and advantageous. Many growers express their intention to continue the use of the product in future, both when the soil is prepared and in combination with fertilizers throughout the season.

At the time of the emergence of white-fly houses treated were apparently free from infestation, indicating good control due to this product.

During the period of Cladosporium development it was thought that the fumes liberated from the product were having a cleansing effect on the plants. In order to test this an extra liberal surface dressing was given to a whole house, but it was found that this method of using the product does not control Cladosporium. Its chief benefit appears to be in assisting to build up a robust plant to resist the disease for a longer period, and as a soil-insect controllant.

WATERING AND ATMOSPHERIC MOISTURE.

Though Cladosporium is not usually prevalent until the warmer, dry weather, there is ample evidence to show that plants reared in a close humid atmosphere, causing tender growth, are more readily attacked and suffer more rapidly than hardier plants reared under dry conditions. Where plants are put out in dry or nearly dry land, and watered liberally periodically during growth, soft conditions are produced, and excess moisture is generally condensed on the glass.

In order to test the effect of this moisture on Cladosporium a house was so arranged that while an adequate amount of root-moisture was

available the relative humidity of the atmosphere was as dry as possible. This was done by opening up furrows in the ground and well watering several times prior to planting. As the ground was levelled for planting, the surface soil was reasonably dry. The plants made very good establishment in growth, requiring very little watering during the bad-weather period. As the weather became more settled and warmer, more abundant water was supplied at regular intervals. Under this programme the house had a much drier atmosphere, and there was no condensation on the glass when the house was closed—a desirable state of affairs, but one not readily attained when all water is applied during growth. The plants were well grown, of a hardy type, short-jointed, and resisted Cladosporium far better than more tender plants.

FERTILIZERS.

Complete fertilizers are necessary prior to or at planting, regardless of what it is intended to apply later, though at the earlier stage nitrogen should not be in the readily available forms.

Young plants set out with dried blood alone were very stunted, hard-wooded, with copper-coloured foliage, and very backward six weeks after planting, showing no sign of flower-buds. With sulphate of potash alone the plants were hard-wooded, short-jointed, more natural in colour, but not luxuriant, and showing bud development of flower. Superphosphate alone gave good growth and colour, with the plants showing open trusses of flower, but Cladosporium was present on most plants. Good, strong plants, very thrifty at the open-flower stage, resulted from complete fertilizers.

With regard to further dressings of fertilizers, generally super as a dominant has a pronounced effect in encouraging Cladosporium. Potash retards the trouble, but under its dominant influence plants do not come forward with sufficient vigour to be well established in the race against mildew. Nitrogen in dominance rushes the plants forward, and also has a retarding influence on the disease when applied, as the plants are at a susceptible period.

SUMMARY.

With present-known control measures Cladosporium may be expected in the district about mid-October. Endeavour should be made to have the plants forward and hardily grown prior to this. Dry atmospheric conditions should be maintained during winter, the majority of the water required being applied prior to planting, and good ventilation also maintained. The use of White Island product prior to planting, and soil-surface dressings during the season, appear to control soil insects and result in more robust plants capable of considerable resistance. Super in excess disposes the plants to Cladosporium. Complete fertilizers are advisable when the land is prepared for planting, together with nitrogen in a not immediately available form. Nitrogen should be freely used when the disease first appears. Top vegetation should be encouraged after stopping, so as to provide foliage to carry the plants through the attack.

NOTE.—The writer desires to record appreciation and thanks for the valuable assistance given in connection with these experiments by Mrs. A. Angus, Messrs. A. Currie, J. E. Fleet, G. Johnston, R. Lean, and White Island Products, Ltd.

TOP-DRESSING OF NORTH AUCKLAND HILL LANDS.

SOME EXPERIMENTAL RESULTS ON SANDSTONE COUNTRY.

C. J. HAMBLYN, B.Ag., Instructor in Agriculture, Whangarei.

DURING the past two seasons manurial top-dressing trials have been carried out under the direction of the writer on an area of more or less deteriorated hill land on the property of Mr. R. F. Ellis, near Kaipara Flats. The experiment was designed somewhat on the lines set out in an article in the *Journal* for November, 1926, dealing with the top-dressing of King-country hill lands. Accurate records were kept of the cost of application of the fertilizer and of the stocking of each paddock top-dressed, as well as of an area adjoining which was not treated in the first season.

The area selected for the trials consists of some 90 acres of typical sandstone hill land representative of large areas of similar country throughout the North Auckland Peninsula. Originally carrying good mixed bush, and sown to English grasses from twenty to forty and more years ago, the deterioration has varied according to the management and the type of stock carried, until at the present time there is a wide variation in the type of pasture and second growth on these lands. However, whether brown-top, danthonia, or paspalum have come in to form a sward and prevent a covering of bracken fern, hard fern, or manuka, or whether the reversion has been to these forms of secondary growth, the results as far as the stock carried is concerned have been the same —a replacement of breeding-ewes by mature cattle and sheep, and a considerable reduction in the number of stock carried.

In the case in question the carrying-capacity, as shown by the records of a 50-acre block with a general southerly and westerly aspect, was not more than one-third of a sheep and one-sixth of a cattle beast per acre, and the owner found it extremely difficult to make any impression on the heavy growth of bracken fern without severely punishing the cattle.

The top-dressing was carried out on two adjoining paddocks, each of 20 acres, No. 1 being treated with superphosphate and No. 2 with basic slag.

PADDOCK NO. 1.

This area slopes generally to the north and west, and the pasture consists mainly of danthonia, with cocksfoot still persisting among the growth of bracken fern which covered about half the paddock. Blackberry was also bad in places.

In the first season this area was top-dressed at the end of September, 1925, with 3 cwt. of superphosphate per acre, and stocked alternately with sheep and cattle throughout the year. The total cost, including freight, cartage to the farm and paddock, and application by hand, worked out at £1 4s. 10d. per acre. The carrying-capacity of the paddock for the year ending 30th September, 1926, as shown by the records of stocking, was four-fifths of a sheep and two-fifths of a cattle beast per acre.

The paddock was again top-dressed at the end of June, 1926, with 1½ cwt. super per acre, and the records of stocking were kept until the end of September, 1927, when the carrying-capacity for the year worked out at two sheep and one-eighth of a cattle beast per acre. The considerable decrease in the proportion of cattle was due partly to difficulty in securing sufficient stock, and to the fact that the combination of top-dressing and heavier stocking in the previous season had cleaned up the paddock sufficiently to allow of the cattle on the farm being used on new areas. However, there is no doubt that the proportion of cattle to sheep could have been increased with benefit to the paddock and little reduction in the number of sheep carried.

In addition to the increased carrying-capacity, the benefits of the top-dressing were most marked in improvement of the pasture sward, the better wintering of the stock, and (it was held) the increased wool

GENERAL VIEW OF THE COUNTRY EXPERIMENTED ON.

return per sheep. Moreover, most of the sheep-stocking during the spring and summer was done with ewes and lambs. Perhaps one of the most interesting items noted towards the end of the second year was the manner in which the blackberry had been prevented from seeding through being kept closely grazed by the sheep, and by the choking effect of the stronger growth of paspalum and danthonia around the crowns.

PADDOCK NO. 2.

This area, also of 20 acres, slopes generally to the south and west, and the pasture consists mainly of brown-top, with paspalum and danthonia on the drier slopes. A considerable portion of the paddock was covered with a dense growth of bracken, together with patches of hard fern and manuka. Strong blackberry had taken charge in some

of the steeper gullies. This was cut and burned, and grass-seed sown before the paddock was top-dressed. The fire got away in places, and an area of several acres on the ridges was also burnt off.

The paddock was top-dressed with 3 cwt. per acre of basic slag in August, 1925, and the carrying-capacity for the year worked out at nine-tenths of a sheep and one-fifth of a cattle beast per acre. The ground was again top-dressed at the rate of 1½ cwt. of slag in June, 1926, and the carrying-capacity increased for the year ending 31st August, 1927, to two sheep per acre, while the number of cattle carried was reduced to only one-twenty-fourth of a beast. Here again shortage of cattle affected the good results, which would have been much better as far as the pasture was concerned had more cattle been used. Though the fern-growth was reduced to scattered patches during the winter of 1926, the reduction of the cattle carried allowed it to get away somewhat during the following spring, but the improvement in the grass sward prevented anything like the spring growth of previous seasons, and Mr. Ellis is confident that he can deal with it without detriment to the stock.

50-ACRE BLOCK.

The 50-acre block already mentioned was top-dressed in June, 1926, with 1½ cwt. of fertilizer per acre, half being treated with superphosphate and half with basic slag. Little improvement was noted in the pasture until the following autumn, but the carrying-capacity was improved from one-third of a sheep and one-sixth of a cattle beast to $1\frac{1}{10}$ sheep and one-ninth of a cattle beast, while the stock dealt more effectively with the growth of fern than they had previously been able to.

GENERAL.

The cost of applying the fertilizer per acre in 1925, using 3 cwt., worked out at £1 4s. 10d. in the case of the superphosphate, and £1 4s. 6d. for the slag. With the reduction in freight on the railway, and a reduction in the cost in Auckland of £1 10s. per ton for super and of £1 per ton for slag, the top-dressing with 1½ cwt. in 1926 cost 10s. 7d. and 11s. 2d. per acre respectively. This makes an average of between 17s. and 18s. per acre for the two seasons.

Though the foregoing results may not appear to be altogether encouraging, there is no doubt that considerable interest in the trials has been created in the district, and those farmers who have attended field-days on the area or visited it at different times are confident that top-dressing combined with better stocking is infinitely better than the old system of continually burning off or depending on cattle alone in the endeavour to get rid of or control the bracken fern.

Both the 20-acre paddocks have again been top-dressed at the rate of 3 cwt. per acre, making a total of 7½ cwt. in three years, or an average top-dressing of 2½ cwt. per year. The idea of this last dressing is to see if a still further increase in the carrying-capacity can be made; it is also an endeavour to clean up the paddocks so that they can be easily maintained in good order. Records will be kept of the stocking for the next two or three years—when probably no top-dressing will be done—in order to observe the after or residual effects of the fertilizers and the rate of deterioration in the two paddocks.

From general observations made during the last two seasons the writer is of the opinion that at least 2 cwt. per acre is necessary for obtaining immediate results; that where fern is at all bad 3 cwt. per acre in the first year, followed by 1½ cwt. in the second, is better than 2 cwt. to 2½ cwt. each year; and that it is more economical to top-dress one area in two successive seasons than to proceed from one paddock to another each year.

NOTE.—The fertilizers for these trials were supplied by the Auckland Fertilizer Manufacturers' Association and Auckland Manure Merchants' Association, who provided the superphosphate and basic slag respectively, and the assistance thereby rendered is duly acknowledged. Thanks are also due Mr. Ellis for the efficient manner in which he kept the records, and for the interest taken by him in organizing field-days and showing visitors over the area.

GRAPE-VINES FOR NEW ZEALAND CONDITIONS.

RECENT TRIAL IMPORTATION OF EUROPEAN VARIETIES.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

WITH a view to extending its experiments in the selection of suitable grape-vines, and to keep abreast of the increasing interest taken in the culture of outdoor grapes throughout New Zealand, from Central Otago to the north of Auckland, the Horticulture Division imported last year a number of European varieties of vines from France, particulars of which are given in the accompanying list. The vines have been selected for qualities which are most likely to render them suitable for the needs and conditions of the Dominion, and from them it is hoped to reselect a number which can be added to those that have already proved their worth under the numerous local conditions of both Islands. An important feature in the choice made is the selection of vines from a point of view of early ripening, which is an essential condition for their successful adaptation to climatic conditions in the cooler parts of the Dominion.

The vines were treated before despatch from France with a fungicide and insecticide, and received a similar treatment on arrival here. They were then grown in quarantine for one growing season, and after being passed as sound and healthy have now been planted in the State experimental vineyard at Te Kauwhata, whence they will eventually be made available for viticulturists after having been given a thorough trial under the supervision of officers of the Horticulture Division.

Besides some of the best varieties of pure European vines, the collection includes a number of American × European hybrids known as "direct producers." The object of the hybridizers has been to produce fruit having the finer qualities of European vines on vines having the disease-resistant qualities of the American varieties. Many thousands of these hybrids have been produced and tested in France during the last forty years, but few have given satisfaction. It is from among these that a choice has been made. Some of the vines are said to give the best results on their

own roots, while others do better grafted on resistant stocks, particularly on the hybrid Baco No. 1 stock and the Riparia × Rupestris 3309. Some of these hybrids require no spraying in France, while others require from one to three treatments against downy mildew.

The quality of the fruit, and the wine which is made from it, are the subject of much discussion in the European viticultural world. Taking a mean course through the conflicting opinions expressed, the best of the direct producers are heavy producers of good fruit and wine without attaining to the higher qualities of the aristocrats of ampelography, the leaders of which—the Cabernets, Pinots, and Rieslings—are now well established in New Zealand. The direct producers should prove valuable for cultivation in the districts where humid climatic conditions are favourable to the development of fungous diseases, and where the cost of spraying is a considerable item in growing the finer varieties.

Included in the recent importation are also a few additions to our collection of resistant stocks.

LIST OF VINES IMPORTED IN 1927.

Abbreviations indicating approximate ripening periods: 1, Late February and early March; E, a week later than 1; V E, a fortnight earlier; 1 L, a week later; 2, a fortnight later.

No.	Variety.	Colour.	Ripening Period.	Remarks.
1	Alphonse Lavallée ..	Black	2	Belgian under-glass table grape, suitable for outdoor culture also.
2	Chaouch	White	2	Turkish table grape; one of best grown.
3	Chasselas Doré Salomon	White	1	Selected Golden Chasselas, universal table and wine grape.
4	Chasselas Rose Salomon	Rose	1	Selected Chasselas Rose; table.
5	Gradiska	White	2	One of handsomest grapes grown; outdoor and under glass.
6	Lignan	White	1	Excellent table grape; also used for wine. To obtain best results growth should not be restricted too much.
7	Madeleine Alice Salomon	White	V E	Table grape; seedling of Madeleine Angevine, but sets its fruit better.
8	Madeleine Royale ..	White	E	One of best early table varieties.
9	Muscat Salomon ..	White	1	Table grape with fine Muscat flavour.
10	Aligote	White	1-2	Makes excellent wine in Burgundy district.
11	Chenin Blanc ..	White	2	Celebrated wines of Saumur and Vouvray.
12	Chenin Noir ..	Black	2	Makes a good wine on clay soils.
13	Cinsaut	Black	2	Excellent table grape, and produces one of best wines of Southern France.
14	Gamay Gloriod ..	White	1	Wine. Vigorous and fertile vine.
15	Gamay de Beaujolais	Black	1	Gives abundance of good ordinary wine on most soils, and high-class wine in Beaujolais district of France.

LIST OF VINES—*continued.*

No.	Variety.	Colour.	Ripening Period.	Remarks.
16	Gamay Hâtif des Vosges	Black	V E	Table and wine. Fertility and quality of wine equal to any of the Gamays. Well-known " Vin Gris des Vosges " is made from it. Should ripen its fruit in coldest parts of New Zealand.
17	Gamay Teinturier ..	Black	1	Wine. Has dark-red juice. Should be blended in proportion of one-fifth with other black Gamays; increases colour without detracting from quality of wine.
18	Lasca	Black	1	Makes good wine. Resists rot and accommodates itself to most soils. Should be allowed to extend freely—pruned light.
19	Limberger ..	Black	1 L	Table and wine. Heavy bearer. Good ordinary wine.
20	Malvoisie Rose ..	Rose	1	Excellent table grape, which produces high-quality white wine. Gives optimum results with light pruning.
21	Melon (Muscadet) ..	White	1 L	Produces high-class wine of Chablis type on stiff clays.
22	Merlot	Black	2	Makes a smooth wine, and when blended with Cabernet and Malbeck helps to produce finest Bordeaux wines. Good cropper.
23	Mondeuse	Black	2 3	Wine similar to Syrah (Hermitage), but vine a heavier bearer. Favourite in frosty regions of Savoy.
24	Muscadelle ..	White	2	Vigorous and fertile. Produces celebrated wine of Montbazillac, and is blended with Semillon Blanc in making Sauterne wine. Does well on clay.
25	Noir Hâtif de Marseille	Black	V E	Produces good table and wine grapes at extreme northern limit of the European viticultural region.
26	Pinot Blanc de Bronner	White	1 E	Selected Weisser Kloevner (see below), produces high-class wine.
27	Pinot Blanc Hâtif (gros)	White	1	Same character as Pinot Blanc Chardonnay, the Chablis grape, but has larger bunches and berries.
28	Pinot Noir Comte Odart	Black	1	Selection of well-known Champagne and Burgundy variety, Pinot Noir, which it surpasses in fertility.
29	Pinot Noir Oberlin ..	Black	E	Produces remarkably fine wine.
30	Pinot Noir Reveney..	Black	1	Selection of Pinot Noir, of which it has the same characters added to a greater fertility.
31	Pinot Noir St. Laurent	Black	1 E	Is recorded as producing crop of grapes equal to double that of best selected Pinots, and makes an excellent wine. Will be interesting to compare this variety with Pinot Meunier under New Zealand conditions.

LIST OF VINES—*continued.*

No.	Variety.	Colour.	Ripening Period.	Remarks.
32	Portugais Bleu ..	Black	1	Fine table grape, very vigorous and fertile; largely grown for Paris market. Makes a good red wine blended half-and-half with Pinot Noir St. Laurent, and good ordinary white wine blended with one-third Early Malingre or Madeleine Royale.
33	Poulsart Blanc ..	White	2	Good table and wine grape. Is very productive on level ground, and makes good wine on clay hills.
34	Poulsart Noir ..	Black	2	Good table and wine grape.
35	Sauvignon Blanc ..	White	2	Is blended with Semillon to make renowned Sauterne wines.
36	Semillon (gros) ..	White	2	Leading white grape of Bordeaux district. Famous Chateau-Yquem Sauterne wine is made from this variety.
37	Tannat	Black	2	Produces excellent, very deep-coloured red wine. Does well on clay soils.
38	Weisser Kloevner ..	White	1	White Pinot, largely grown in Alsace. Good all-round wine variety, making an excellent wine, bears well, and is resistant to fungous diseases. Recommended as a main crop for production of white wine.
58	Agostenga ..	White	E	One of best early table grapes, but too delicate to stand transport and marketing conditions.
59	Goldriesling Blanc (Riesling × Courtiller Musque Précoce)	White	1 E	Table and wine grape, producing heavy crop of handsome golden berries.
60	Rousette	White	2	Produces renowned sparkling wines of Saint Perry (Rhône).

Hybrid Direct Producers.

No.	Variety.	Colour.	Ripening Period.	Remarks.
39	Baco No. 1 (24-23) ..	Black	E	In addition to other qualities, has proved to be good stock for other direct producers.
40	Baco 2-16 (Totmur)	White	V E	Table and wine.
41	Baco 30-12 (Estallat)	Black	1 L	Table and wine.
42	Bertille Seyre 893 ..	Black	1 E	Wine.
43	Castel 19637 ..	Black	1 E	Wine.
44	Couderc 7120 ..	Black	2	Table and wine.
45	Gaillard-Girard, 157	Black	1 L	Table and wine.
46	Oberlin 595 ..	Black	V E	Wine.
47	Oberlin 782 ..	White	E	Table and wine.
48	Siebel 880 ..	White	1	Wine.
49	Siebel 1000 ..	Black	1	Table and wine.
50	Siebel 2003 ..	Black	1	Table and wine.
51	Siebel 2007 ..	Black	1 L	Wine.
52	Siebel 4643 ..	Black	1 L	Table and wine.
53	Siebel 4986 ..	White	1 E	Wine.
54	Siebel 5279 ..	White	E	Table and wine.
55	Siebel 5409 ..	White	1	Table and wine.
56	Siebel 5455 ..	Black	1	Table and wine.

LIST OF VINES—*continued.*

No.	Variety.	Colour.	Ripening Period.	Remarks.
	Resistant Stocks.			
39	Baco No. 1 ..	..	..	..
57	Solonis × Riparia 1616	..	..	..
61	31 Richter ..	..	..	..

Visitors to the Te Kauwhata Horticultural Station (lower Waikato district), where the experimental vineyard is situated, can on working-days, in addition to the numerous varieties of previously introduced vines, inspect the following American table and grape-juice vines imported from the eastern United States and Canada in 1922. These varieties ripen their grapes from the middle of February to the middle of March in normal seasons.

Variety.	Colour.	Ripening Period.
Diamond	White	Early.
Eclipse	Black	Very early.
Brighton	Red	Mid-season.
Herbert	Black	,,
Lucile	Red	Early.
Niagara	White	Mid-season.
Lutie	Red	Early.
Campbell's Early	Black	,,
Hicks	,,	Mid-season.
Moore's Early	,,	Early.
Worden	,,	,,
Philip	,,	,,
Concord	,,	Mid-season.
King	,,	,,
Stark's Delicious	Red	,,
Barry	Black	,,

A collection of choice varieties of Italian table-grape vines is expected to arrive about June of this year.

Shearers' Accommodation.—The administration of the Shearers' Accommodation Act has continued to be carried out by the Live-stock Division, and it is satisfactory to report that a gradual improvement in the accommodation provided generally is being effected. Consequent on complaints to the Minister of Labour regarding the conditions of the accommodation provided on the East Coast and Hawke's Bay districts more particularly, arrangements were made for a comprehensive inspection of the sheds in these districts by a responsible officer. Generally the accommodation was found to be satisfactory. In all cases when the contrary was found instructions were issued and arrangements made to enforce compliance. In a number of cases bunks and mattresses were not in evidence, and these were ordered to be supplied. It is usually asserted that the Native shearers, who are largely employed on the East Coast, do not use the bunks when provided ; but, on the other hand, complaints were made by representatives of the Maoris that they are not provided, and in the circumstances it is not unreasonable to require that they be available for use.—*Annual Report of Live-stock Division, 1926–27.*

INCIDENCE OF CONTAGIOUS MAMMITIS.

DANGER OF CHRONIC CASES IN DAIRY HERDS.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

AN excellent example of the danger of cases of chronic contagious (streptococcic) mammitis was met with recently during experiments carried out at the Wallaceville Veterinary Laboratory.

The ordinary milk-souring organism (*Streptococcus lactis*) causes an acute inflammation of the udder when injected through the teat-canal, but this passes off in a day or two, leaving the quarter none the worse. An experiment was being carried out to ascertain whether by setting up mammitis in this way, and then passing it on from one cow to another, the power of the sour-milk streptococcus to cause mammitis would be increased. An old cow "A" was inoculated with a sour-milk organism, and, as usual, developed well-marked inflammation of the quarter. Milk from this quarter was then injected up the teat into the quarter of another beast, "B"—a first calver which had always had a normal udder. Mammitis resulted, and some days later it was found that the condition in this second animal was not due to the milk-souring organism but to the usual organism causing streptococcic mammitis in cows (*Streptococcus mastitidis*).

From this the question arose whether the comparatively harmless milk-souring organism had, in passing from "A" to "B," changed its nature and developed into the markedly harmful *Strep. mastitidis* (a phenomenon which some eminent research workers have thought might occur).

The experiment was then repeated, using two first calvers with normal udders, "C" and "D." In neither of these, however, did *Strep. mastitidis* develop, but only the brief, passing inflammation due to *Strep. lactis* being brought on.

Then on looking up the past record of the cow "A" it was found that two years ago she had been infected with *Strep. mastitidis* in the same quarter as was now used. She had, apparently, overcome the infection, and the milk had since that time remained quite normal in appearance, though with the microscope a few inflammatory cells could always be found. In spite of her apparent recovery, however, she was still harbouring the *Strep. mastitidis* in her quarter, and this caused infection in "B."

It is felt that this case is worth bringing to the notice of farmers, as very many cows which have a similar history to that of "A"—namely, an attack of mammitis and apparent recovery—exist in dairy herds and are regarded as normal by the owner, who therefore takes no precautions with them. Doubtless, as shown in the experiment, they are in many cases still harbouring the organism that originally caused them to show acute mammitis, and are consequently reservoirs of infection for their herd-mates. Cows affected in this way are always liable to have a recurrence of the disease, and should be very carefully watched so that they may be isolated at the very commencement.

It is felt, also, that the presence of such a cow in a herd is often the explanation of sudden inexplicable or recurring outbreaks of the disease.

IMPROVEMENT OF PHORMIUM TENAX.

RESEARCH ON BREEDING AND CULTIVATION OF THE PLANT.

DURING the past few months Dr. J. S. Yeates, of Wellington, has been conducting an investigation into the improvement of *Phormium tenax* (New Zealand flax) under the auspices of the Council of Scientific and Industrial Research. Progress reports by Dr. Yeates, dated 5th and 12th December respectively, have been made available as under :—

The following is a summary of the work done in the last three months on the cytology and genetics of phormium. It will be recollected that my task was primarily to find the chromosome numbers of phormium species and varieties, with a view to hybridizing. There are two species, and many of the varieties are supposed to be hybrids between these two species. If the chromosome number is not the same in all species and varieties, then hybridizing will lead to irregular results. Such difficulty has been found in crossing some kinds of wheat.

I have made preparations and counted the chromosomes of over thirty varieties of flax, including representatives of both species. The chromosome number in all these is the same—namely, 16—and the behaviour of the chromosomes is regular throughout. From the breeder's point of view this result is extremely satisfactory. It means that cross-fertilization between any two varieties should give normal Mendelian results.

By using a new rapid method the above work was done in a small part of the time ; the remaining time has been spent in studying (1) the courses of the fibre-strands through the leaf ; (2) the differences between varieties, commerical and otherwise ; (3) the question of whether or not the varieties breed true from seed.

The general conclusions are as follows : (*a*) That it should be possible to cross successfully any two varieties of flax which flower at about the same time. (*b*) That, in general, varieties do not come true from seed. (*c*) That in the near future planting will be done chiefly with hybrid seedlings which will be the first generation from crosses between suitable parent varieties. The parent varieties will be selected for resistance to disease, quality of fibre, and yield per acre. The hybrid offspring should grow more vigorously and combine the desirable qualities of two or more natural varieties.

It has already been stated in a preliminary report that the chromosome numbers of flax varieties have been found very favourable for breeding-work. This aspect requires no further mention here.

The brief reference made in the report concerning the failure of flax to come true from seed needs some qualification. It would be presumptuous to say at the present time that no flax breeds true. It is highly probable that pure breeding strains do exist in some isolated localities where cross-pollination is difficult. My view that most

varieties do not breed true is based on examination of several batches of nursery-grown seedlings, each batch nominally being of one variety. In every case it was found that there were seedlings obviously of different varieties. The differences are sometimes so marked that certain kinds of seedlings are "weeded" out from the rows of young flax-plants.

Two separate aspects of this failure to breed true need consideration here. First, there can be no doubt that a fairly large proportion of the seedlings resemble the seed parent. It is therefore possible to select from the seedlings plants which resemble the parent. The main objection to this is the great amount of extra expense involved in selecting the right seedlings and in growing the rejected plants until they are old enough to be distinguished.

The second objection is concerned with a loss of hybrid vigour in the plants. A self-pollinated flax-plant produces mixed seedlings because the plant itself is already a hybrid. The seedlings, however, will show the effects of hybrid vigour much less than does the original hybrid. In America, for instance, it has been found that crossing two varieties of plants may give a hybrid with 50 to 100 per cent. more vigour of growth than either parent. The seed from these hybrids, however, grew into plants with about one-half of this hybrid vigour. This loss of vigour appears to be the same as the effect of close "inbreeding" of animals. From this it should be plain why hybrid flax-seedlings are considered best. If seedlings are to be planted they should be as vigorous as possible; in other words, they should be the original hybrids. A single pod or capsule of flax produces about a hundred seeds, and this number of plants would result from a single cross-pollination. About 1,500 seedlings are required to plant 1 acre, so that the task of raising hundreds of acres of seedlings from artificial pollination should be quite possible and profitable.

It is hardly necessary to add that hybrid vigour is a secondary aim in crossing. The combination of desirable qualities is the main object. In the short time at my disposal I have paid some attention to the characters which are most desirable in flax. The most outstanding of these are (1) resistance to disease—especially yellow-leaf; (2) strength of fibre; (3) percentage of fibre; (4) vigour of growth; (5) colour of leaf-butt—white or otherwise; (6) shape of leaf-tip.

Resistance to yellow-leaf is one of the most important problems. So little is known about the disease that only careful examination of affected areas can show what varieties, if any, are immune.

Strength of fibre is a matter which needs a great deal of attention. Flax-fibre sells for its strength, and failure to maintain a good standard in this respect will create a prejudice against the fibre which would be very difficult to overcome. There are varieties of flax which produce fibre stronger than manilla, and there is no reason why, in time, our fibre should not approach that standard. Strength is estimated at present by breaking in the hand. Strength of fibre no doubt varies from plant to plant, from leaf to leaf, from one part of the leaf to another, and even from fibre to fibre in one part of the leaf. There is great need here for accurate strength tests made by suitable machines so that results can be given in actual figures.

The question of fibre percentage is a difficult one. When flax-cultivation becomes further developed the yield of fibre per acre will be of more significance. Yield per acre will depend partly on percentage of fibre, but also on the manner and rate of growth of leaves and roots of the plant.

That white-butted varieties produce fibre of better colour cannot be questioned. Such plants are comparatively rare, and it is doubtful if they are the best fibre-plants from other points of view. Crossing to combine white-butt with other required qualities is the obvious remedy.

The shape of the leaf has a close bearing on uniformity of length in the fibre. I have definite information of one variety at Shannon the leaf-tips of which are almost square. This character should give a leaf which has many fewer short fibres "running out" along the margin owing to taper of the leaf.

Besides these characters, there are others which must be kept in mind with a view to changing conditions in the industry. For example, cultivation of flax in rows will create a demand for types especially suited to these conditions. An exceedingly rigid, moderately tall, and close-growing plant should allow closer planting, or more easy access for cultivation, and would be much more suitable than drooping types for cutting by machinery.

A good plan of work for flax-improvement should be as follows :—

There should be a central experimental nursery in which varieties of phormium could be collected for comparison and breeding. The flax areas throughout the country should be carefully examined and selected plants sent to the central nursery. A survey of this kind would aim at finding and describing all varieties, determining by their associations any possible relationships between the varieties, the effect of environment on growth, and, in yellow-leaf areas, much should be found as to immune varieties.

Hybridizing should begin at once, but from five to eight years would be required before any improved varieties could be ready for planting. For more immediate planting, seed should be collected from the best flax-types and either the seed or the seedlings supplied to flax-growers.

Experimental work should be undertaken in conjunction with growers to decide several questions which are most urgent. The chief one of these problems is that of the effect on flax of changed conditions and cultivation. For instance, one grower has found on the high country around Mount Ruapehu flax which produces good leaf there. Seed of this flax has been grown near sea-level. The question is, Will the plant produce the same quality and quantity of fibre under the new conditions? The same doubt exists concerning changes from sand-dune to swamp, and *vice versa*. Only careful work can be trusted in things of this kind. Fans of one large bush, which would all be the same, should be planted in different localities and careful records kept of their growth and production of fibre.

Experiments on manuring and cultivation should be treated in the same way. The fundamental principle should be that comparison should always be between sets of plants of one variety. It is hoped that growers may be induced, when planting, to set aside small test areas in which only one selected variety would be planted.

In conclusion, it may be emphasized that the time is overdue when flax-growing should be placed on a scientific basis. Keen competition in the world's markets demands both an improvement in quality and in uniformity, and a reduction of labour costs, the latter being one of the largest items in the production of phormium fibre. Everything seems to indicate systematic cultivation and mechanical handling of flax as the chief remedy.

It is only to be expected that repeated cutting of heavy crops off uncultivated swamps would lead to deterioration both in quality and quantity—an expectation which appears to be fully borne out by the experience of millers. In addition, the swamp has the disadvantages of expensive cutting and carrying, and of mixed varieties. Cultivated flax would almost certainly be cut by mechanical means, and the same tractor used for cutting would be available for hauling.

The preliminary work on selection, breeding, and cultivation should be done before planting begins on an extensive scale. That it is really worth doing is shown by the fact that much has been done already by individual millers. Messrs. A. and L. Seifert, B. B. Wood, A. Wall, and G. Seifert may be mentioned especially. Valuable as work by individual concerns may be, there can be no doubt that combined work by all interested has everything in its favour. It is waste for several men each to spend time and money on the same problem ; nor can one man, or a company, often afford to look far enough ahead in its programme of research. The industry in New Zealand is small ; it must stand or fall as a unit. The pooling of experience already gained, and co-ordination in future research, appear to offer the most hopeful lines of advance.

CHECKING OF MILK AND CREAM TESTS AND CREAM-GRADING.

AN officer of the Dairy Division (Mr. G. R. B. Boswell) has been recently appointed to systematically undertake the checking of milk and cream tests among the dairy factories, and to assist in the work of co-ordinating cream-grading.

Check testing can be carried out for some days after the expiry of each testing-period, and will probably be applied primarily to dairy companies evidencing seasonal yields which are considered to be too high. Despite publicity respecting yields, some are undoubtedly higher than should be the case.

The Instructors in buttermaking have been giving much attention to keeping the cream-grading standards uniform as between the various factories. Part of the new officer's time will be utilized to assist in this work. It is very satisfactory to note that the great majority of dairy companies have co-operated splendidly in regard to cream-grading. Every possible attention has been given by Instructors to complaints respecting inaccurate grading. Some of these complaints have been justified, but the majority were probably founded only on rumour, and were of no consequence.

—*W. M. Singleton, Director of the Dairy Division.*

CALF-MARKING.

THE MOVEMENT IN NEW ZEALAND.

"CALF-MARKING" is the term applied to a system of ear-tattooing which provides permanent identification of heifer calves sired by registered purebred bulls from cows tested for yield and proved profitable butterfat producers.

In this country the system was inaugurated by the New Zealand Co-operative Herd Testing Association, operating in the Auckland District, 305 calves having been marked in 1925–26, the first year of operation. Besides this organization, the system is now being carried out by at least seven other herd-testing associations, as follows: Bay of Plenty Group Herd Testing Association, Wairarapa Herd Testing Association, Northern Wairoa Herd Testing Association, Te Aroha Herd Testing Association, Taranaki Co-operative Herd Testing Association, Bush-Horowhenua Herd Testing Association, Bay of Islands Herd Testing Association. Possibly there are others of which the Department has no advice, but the list given serves to indicate that the movement is developing rapidly in the North Island. Several more associations are arranging to take up the work next season.

Statistics showing the total number of calves marked in the Dominion last spring are not available, but the New Zealand Co-operative Herd Testing Association advises that it registered some four thousand calves.

As already indicated, the marking is carried out by means of a perforated stained tattoo in the ear, and is confined to heifer calves. The calf must have been sired by a registered purebred bull, and the dam must have produced, in a lactation period of not more than 305 days, a certain minimum butterfat requirement according to age. For a first-calver the standard is set at 250 lb., for a second-calver 275 lb., and for a third-calver or older animal 300 lb. In addition, the dam must be branded or otherwise identifiable under the rules of and in a manner satisfactory to the association. For purposes of calf-marking only heifer calves from dams that have actually been tested by certain herd-testing groups are registered. Particulars of calves qualifying under the rules of the association are entered in a register and a certificate is issued.

The actual system of marking may be outlined as follows: A general index letter—" T "—is the registered mark of the Dominion Group Herd Testing Federation. This index mark, of course, remains permanent. The index mark is followed by a letter which indicates the dairying season in which the calf was born, thus providing a key to age. This age or year letter is followed by the registration number of the calf in the Heifer Calf Register. Thus, for instance, " T B 555 " would indicate that the calf so marked was number 555 in the register of the Dominion Group Herd Testing Federation for the year 1926–27.

The influence of calf-marking properly carried out should ultimately be far-reaching and of great assistance to the dairy industry. It provides a means of identifying calves with more or less proved butterfat backing, and, in districts where calf-marking is in operation,

distinguishes what should be a profitable producer and useful herd-builder from the lower-yielding animal. In this way it should steadily, but surely and automatically, tend to solve the cull-cow problem which has exercised the minds of dairymen for many years. Most of the earlier suggested methods for solving this problem were along the line of branding the cull cow. It would seem, however, that the marking of the good cow is a much more satisfactory process than the branding of the poor one. An unbranded beast may be accepted as an unknown quantity, but a heifer marked under the calf-marking system carries the mark of potential quality, identifying its bearer as the product of a purebred sire and a dam which has proved herself a capable butterfat producer.

In any such system as this there are sure to be many examples of undesirable atavism—throw-backs to inferior types and inferior producers—but, as the result of calf-marking, our average dairy cow should normally improve with each succeeding generation.

RANGITIKEI SAND-DUNE EXPERIMENTAL STATION.

RECENT work at this station, which is operated by the State Forest Service, is referred to in the annual report of the Service for 1926-27 as under:—

The knowledge and experience gained from the experimental work which has been carried out at the station since May, 1921, has enabled larger areas to be treated during the year with better results and at a lower cost per acre. Marram-grass was planted on 372 acres, and, although winds of high velocity were frequent and the rainfall low during the planting season, a very successful establishment was obtained. The area of sand-dunes now planted with marram-grass is 1,045 acres. The planting of exotic pines on the stabilized marram-covered dunes was continued, and 88,650 trees were planted on 130 acres, bringing the total area planted to 315 acres. Between the dunes there is a large area of low-lying rush country which cannot be drained sufficiently for tree-growing owing to the lack of fall. As it is desirable to put this land to profitable use, two experimental plots of flax (*Phormium tenax*) were formed. The result to date is most promising, but it is yet too early to decide whether it will be a profitable undertaking to plant the whole of the wet area, which amounts to over 1,000 acres. Experimental plots of flax and toetoe were also established immediately to the rear of the fore-dune, to ascertain if these species will afford the shelter necessary before trees can be planted successfully in such an exposed position. An experimental planting of kikuyu-grass was also made, and where the sand is less than 1 ft. deep it is growing well and is forming a dense mat. Elsewhere it failed to strike. The tree nursery at Tangimoana supplied 100,300 transplants, which were used in the 1926 planting and to fill the blanks in the work of previous years. Seedlings to the number of 140,000 were transplanted for use in the 1927 planting season.

Noxious-weeds Orders.—The Mangonui County Council has declared winged thistle to be a noxious weed within that county. Gorse has been similarly declared in Kairanga County.

Registration of Orchards.—Regulations under the Orchard and Garden Diseases Act, gazetted on 19th January, prescribe that applications for registration of orchards shall be made to the Director of the Horticulture Division, Department of Agriculture, in the month of January each year (instead of September as hitherto). Forms of application may be obtained from the Director, or from any district office or Orchard Instructor of the Department. "Orchard" is defined as "any land used for the growing of fruit-trees and the production of fruit for sale," and includes areas carrying fruit-trees that may not have come into bearing.

PREVENTION OF SAP-STAIN IN WHITE-PINE.

TESTS BY STATE FOREST SERVICE.

C. E. DIXON, Forest Assistant, State Forest Service, Wellington.

THIS article presents the results of a series of tests made by the State Forest Service with the object of preventing the sap-staining which occurs in the sapwood of New Zealand white-pine (*Podocarpus dacrydioides*) during seasoning. The work was carried out under the direction of Mr. A. R. Entrican, Engineer in Forest Products.

The sapwood of most softwoods and of some hardwoods becomes discoloured under certain conditions. This discoloration—which may be blue, green, brown, or red, depending on the species, method of formation, and duration of the discoloration—is known generally by the term "sap-stain." The causes of this sap-stain are many, but are all included under the headings of (1) chemical action, and (2) fungal attack.

Sap-stain caused by chemical action is in the main due to the enzymes in the wood, and produces discoloration both in the sapwood and heartwood. Such stains give more or less permanent discoloration to the wood, causing degrading, and often resulting in financial losses.

Sap-stain caused by fungal attack, however, is the most common one, and that affecting white-pine is known as "blue-stain," due to the blue discoloration occurring in the timber, and is caused by several genera of fungi, mainly Penicillium and Cladosporium, which feed on the soluble sugars present in the sapwood. These fungi do not confine their attention to the surface, but penetrate the sapwood, and may, if conditions are suitable, completely permeate it.

A large economic loss is apparent every year as a result of degrade in the timber caused by these sap-staining fungi. It is estimated that an average depreciation in value of 5 per cent. results in white-pine alone from sap-stain losses, and this is equivalent to some £15,000 per annum. As white-pine is the staple wood used for the construction of butter-boxes in New Zealand, the close bearing of this matter on the dairy industry becomes evident.

Laboratory investigations by Dr. J. S. Yeates indicated that borax was the best and most suitable fungicide for sap-stain. As a result the present commercial tests were instituted, using a borax dip as the sap-stain preventive. In addition, methods of piling were also incorporated in the study to determine their effect as control measures. The commercial experiments proved very satisfactory, and it was demonstrated that the borax-dipped timber, stacked in approved fashion, is almost entirely free from the attack of sap-stain fungi. Correct open piling of even untreated timber was also proved to minimize the sap-stain considerably. The cost of treatment is estimated to vary from 2d. to 3d. per 100 ft. B.M., depending on the size of the mill and methods of treating the timber.

Conditions suitable for Growth of Sap-stain.

The development of sap-stain fungi depends on four factors—a supply of air containing the essential element, oxygen; the requisite amount of moisture; a favourable temperature; and the necessary

food substances. Fungi require oxygen for their growth, and even under storage conditions the supply from the air is ample for their propagation. Stagnant air containing a considerable amount of moisture is favourable to the growth of fungi, in that it prevents the drying of the wood. The extent of growth of sap-stain and mould fungi is largely dependent upon the amount of moisture present in the wood. Tests already carried out in New Zealand by the Forest Service have proved that the moisture content of green sapwood of all softwoods is considerably more than 100 per cent. (based on the oven-dry weight of the wood). Thus while drying under normal conditions it is possible for the timber to retain for a considerable time the amount of moisture suitable for the development of fungi. If, however, the timber can be surface-dried by sufficient air-currents the growth of fungi on it can be rendered almost impossible. It has also been clearly established that the fungi grow most rapidly between certain limiting temperatures, which, however, appear to include normal air-temperatures. Food is essential for the growth of the fungi, and this is obtained from the starches, oils, and sugars occurring in the green sapwood. When supplied with these essentials for growth fungi develop rapidly, and often reproduce abundantly. Deprived, however, of any or all of these factors, the fungi will cease to grow and will eventually die. Under normal air-seasoning conditions it is impossible to interfere with the factors temperature, air, and food. Moisture, however, can be regulated to a certain degree by varying the method of piling the timber and thus altering the air-circulation throughout the stacks. Under these conditions growth of the fungi, which, as stated, depends on the moisture present, can be made partially dependent on the methods adopted in stacking the timber.

In addition, therefore, to treating the timber in order to kill the fungi, experiments were also carried out by altering the conditions of piling, in the hope that the conditions suitable for the growth of the fungi might be modified and the attack rendered impossible.

Material tested.

In carrying out the study it was decided to test as far as possible the type of timber most badly affected by sap-stain fungi. With this purpose in view, white-pine sapwood, 1 in. thick, in random widths and lengths, was used throughout. In all 10,000 ft. B.M. was used.

As it had also been proved previously that boards in open-piled stacks become most seriously affected immediately under the fillets, all of the latter used throughout the tests were first treated with the borax dip to remove this factor from the study.

Tests to prevent Sap-stain.

Two types of tests were carried out. The first, which consisted of a chemical treatment, was accomplished by dipping the timber in a saturated solution of borax in water (2 per cent. at normal temperature). The green timber on sawing was completely immersed in the treating-bath, immediately taken out again, drained, and stacked as shown in Fig. 1. The treatment thus given consisted of a surface wetting of the timber only. There was no penetration of the solution into the timber.

FIG. 1. METHOD OF DIPPING AND DRAINING TIMBER TO PREVENT SAP-STAIN.

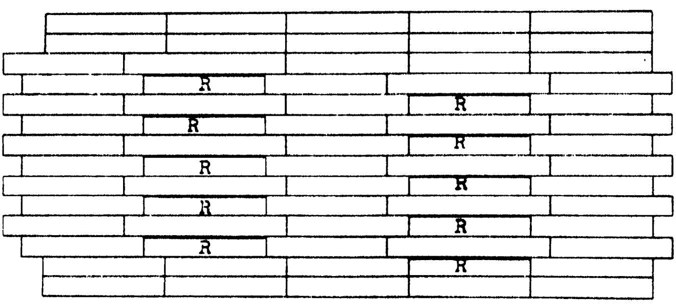


FIG. 2. DIAGRAMMATIC SECTION OF BLOCK-STACKED PILES.

All boards are in contact. Boards used for inspections are denoted by letter R.

The second type, which consisted of a physical test, was carried out by varying the method of stacking, by which means the physical conditions most suited to the development of the fungi can be modified or removed. Two types of piling were accordingly adopted. In one the timber was block-stacked—that is, the boards were piled directly in contact and no air-spaces left anywhere in the piles. The width

of the piles was 30 in., the height 16 in., and the average length 11 ft., although the latter varied, due to the boards supplied being in random lengths, the stacks thus having overhanging ends. A diagrammatic sketch of this type of pile is shown in Fig. 2.

In the other type of piling adopted the timber was open-box-piled —that is, each layer of boards was separated from the layer immediately above and below it by means of fillets. The latter consisted of 3 in. by 1 in. borax-dipped white-pine sapwood, placed on the flat and spaced 4 ft. apart down the length of the stack. The front fillets were placed flush with the ends of the stacked timber, but each succeeding fillet in the height of the stack was placed at a distance of ½ in. forward or in front of the fillet immediately beneath it, thus giving the stack a decided forward lean. These stacks had no overhanging ends, the pile being built up, as its name implies, in the form of a box. To accomplish this the stack was formed from both ends, two boards always lying in the length of the stack, thus allowing the free ends of the boards to occur in the centre of the pile. This minimizes the staining which occurs on overhanging ends, as illustrated in Fig. 7. Additional air-spaces were provided when, due to their length being too short, boards forming the length of the stack did not quite meet. In addition, air-chimneys 6 in. wide, running throughout the length of the piles, were also provided. The finished stack, which is shown in Fig. 4, was 7 ft. wide, 6 ft. 6 in. high, and 22 ft. long, and contained approximately 4,000 ft. B.M. A section of the pile is shown in Fig. 3, and photographically in Fig. 4.

To facilitate inspection each of the boards in all stacks formed was marked with a consecutive number (commencing from the bottom of the stack), and also designated according to the stack to which it belonged. Thus "C.U." represents boards from the close-stacked untreated pile, "C.T." represents boards from the close-stacked treated pile, "O.U." represents boards from the open-stacked untreated pile, and "O.T." represents boards from the open-stacked treated pile.

Representative boards from each stack were examined every week for the first two months, and every month thereafter, for the purpose of determining the extent of stain occurring in each stack. Five representative boards were used for each close-stacked pile, and ten for each open-stacked pile, and were chosen, as illustrated in Figs. 2 and 3, so as to be representative of all parts of each stack. These boards were sawn $\frac{1}{16}$ in. less in thickness, and were of less width than boards directly above them, in order that they might be removed and examined when required. They were further each designated with the letter "R." At the end of eight months the stacks were dismantled and every board examined in detail for signs of sap-stain.

A further series of experiments has also been instituted to determine the effect of the treated timber on butter packed in boxes manufactured from it and exported overseas. As this test will not be finalized until a grading report has been received from London, it will be some time yet before the results will be available. It is confidently anticipated, however, that, as the treatment is only a surface one and butter-box material has to be planed before use, no damage will arise from the use of the treated material.

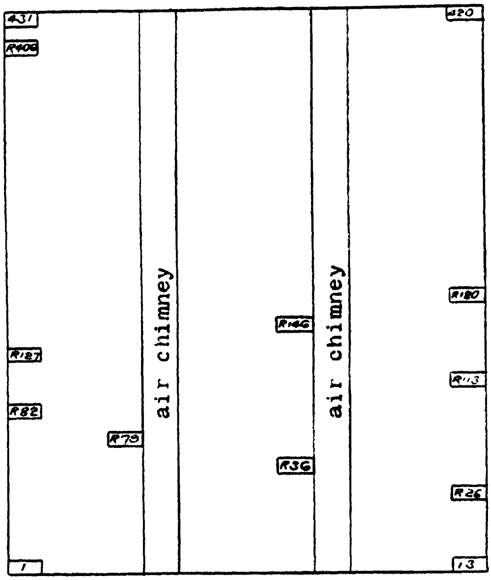


FIG. 3. DIAGRAMMATIC SECTION OF OPEN-FILLETED PILES.

Boards used for inspections are denoted by letter R.

FIG. 4. FINISHED OPEN-FILLETED PILES, SHOWING METHOD OF FORMATION OF PILE.

Analysis of Results.

When the working-plan was drawn up for the study it was laid down that the extent of the stain should be judged on an area basis, and measurements taken accordingly. In the test, however, due to the stain appearing in scattered spots and streaks, &c., as shown in Figs. 5 and 6, this was found impossible, and it was necessary to resort to descriptive methods and photography to obtain an idea of the extent of the stain. The nature of the stain was accordingly described as "streaked," "spotted," or "blotched." Stain occurring in the form of an area in which the length was greater than four times the width was described as "streaked stain"; that occurring in the form of an area more or less circular in shape but under ½ in. in diameter was denoted as "spotted stain"; while that occurring in the form of an area over ½ in. in diameter was described as "blotched stain." The degree of the stain was also recorded, and was described as "light," "moderate," or "heavy," depending purely on its appearance—that is, whether it was light, medium-coloured, or dark. On some boards a combination was found to occur, and in such cases was described accordingly.

Table 1 presents the results obtained from the closely stacked untreated pile. The staining in this pile commenced almost immediately on stacking, and by the end of a fortnight all boards examined had been lightly stained. During the succeeding seven weeks the staining became more intense and darker in colour, indicating that the stain was penetrating the timber. During the next four months, until the dismantling of the stack, there was little increase in the staining. The results of the final inspection are tabulated in Table 5. Blotched stain,

Table 1.—Occurrence of Sap-stain in Close-stacked Untreated Pile.

(Five boards examined.)

Date.	Sap-stain Occurrence.
1927.	
25th March ..	Stack formed.
2nd April ..	Staining, nil.
9th April ..	Scattered, uneven, light-brown spotting, all boards.
16th April ..	Spotting become larger and darker.
23rd April ..	,, ,,
30th April ..	,, ,,
7th May ..	Spotting now covering both sides of all boards.
14th May ..	Staining increased considerably; all boards in stack becoming very dark in colour.
21st May ..	Spots going darker, but not increasing appreciably in extent.
28th May ..	No further increase of stain.
2nd July ..	No increase in stain; two boards turning yellow in places.
30th July ..	No increase in stain.
27th August ..	,,
24th September	,,
27th October ..	Slight increase in stain.

NOTE.—Stack badly sap-stained.

FIG. 5. TYPICAL BLOTCHED STAINING OCCURRING IN CLOSE-PILED UNTREATED STACK.

which represents the largest and deepest type of stain, occurred on 68·6 per cent. of the boards, and is shown in Fig. 5. The stain in these cases was often ½ in. in depth, and the timber was practically useless. Only 0·7 per cent. of the boards were free from stain.

(To be concluded.)

FOOT-AND-MOUTH DISEASE IN BRITAIN.

THE High Commissioner for New Zealand in London cabled under date 3rd February: During January there were 55 outbreaks of foot-and-mouth disease in eleven counties as follows: Leicester, 12; Derby, 11; Lincs, 10; Staffs, 7; Lancs, 4; Warwick, 3; Yorks, Notts, and Glamorgan, 2 each; Surrey and Hunts, 1 each.

EXTERNAL TRADE OF NEW ZEALAND, 1927.

PRELIMINARY figures issued by the Census and Statistics Office show that exports for the calendar year 1927 amounted to £48,496,354, and imports to £44,782,946, leaving an excess of exports of £3,714,408. Corresponding figures for 1926 were —exports, £45,275,575; imports, £49,889,563; balance in favour of imports, £4,613,988. The result for 1927 is therefore £8,328,396 more favourable to the Dominion than that of the preceding year.

Exports show an advance of £3,220,779, a position due mainly to increases of £2,220,193 in butter and £1,131,556 in wool. Other items showing an appreciable advance over the previous year's figures are: Frozen beef, £71,875; frozen lamb, £418,576; calf-skins, £47,194; hides, £120,094. The most noteworthy decreases occurred in cheese, £356,763; rabbit-skins, £146,507; phormium fibre, £52,470: kauri-gum, £54,133; timber, £50,292.

SEASONAL NOTES.

THE FARM.

SUMMER SUPPLEMENTARY FEEDING OF DAIRY COWS.

THE prolonged spell of dry weather experienced this summer has demonstrated the extreme value of ensilage for the summer supplementary feeding of dairy cows. In the Auckland Province permanent pastures, except on the best swamp-land, generally ceased growth early in December, and have since remained in a burnt and dormant condition. Annual forage crops for summer feeding have done badly, and in many cases have failed altogether. Lucerne and paspalum have proved a good stand-by, but for various reasons lucerne is not an important crop in Auckland Province generally, while paspalum, although it has grown well on the heavier and moister soils, has not thrown a great deal of feed where the soil-conditions are very dry. The great advantage of grass ensilage for summer supplementary feeding is that it can be saved in years of good rainfall and abundant grass-growth and kept for dry years. A stack of grass ensilage is the safest insurance policy a dairy-farmer can hold against drought.

The failure of ordinary permanent pastures during the dry weather has naturally turned the attention of dairy-farmers to the desirability of establishing fields of paspalum and lucerne for providing summer feed. There is no doubt that paspalum could be more widely grown in the southern part of Auckland Province than it is at present. The common idea that once paspalum is sown it will eventually spread all over the farm, smother out all the other grasses, and leave the farmer with no winter or early spring feed is quite wrong. Experience has shown that where regular top-dressing is carried out and proper pasture-management methods are adopted mixed pastures of rye-grass, cocksfoot, and paspalum can be maintained. Paspalum will not spread into an ordinary rye-grass, cocksfoot, and clover pasture as long as the pasture has a close sward. Paspalum usually establishes itself in a mixed pasture when the turf is opening up, and really occupies spaces that would otherwise be growing weeds. The best way to establish paspalum is to sow 5 lb. to 6 lb. of seed with the ordinary permanent-pasture mixture used in the district.

Lucerne cannot be so widely cultivated in Auckland Province as paspalum, since it does badly on low-lying soils where the permanent water-level during winter is near the surface. Lucerne naturally does best in a warm, dry climate and a deep alluvial soil well supplied with moisture in the deeper layers. In a wet climate the crop has to contend against the competition of grass and clover, which in many parts of the North Island take possession of the land during the winter and early spring when the lucerne is dormant. The sowing of lucerne should be attempted only on land that is well drained in the winter and that is in a high state of fertility. Over a very large part of Auckland Province summer supplementary feed can be more economically provided by means of grass ensilage and paspalum than by lucerne.

AUTUMN SOWING OF PASTURES.

March is usually the best month for sowing permanent and temporary pastures on ploughed land. Sowing in February is often unsatisfactory owing to the uncertain rainfall; in years of good rainfall, however, February sowings do remarkably well. The seed-bed for sowing grass should be fine and firm from top to bottom. The cultivation operations should be finished with a rolling, and the seed and fertilizer broadcast on the rolled surface. The seed can then be covered with a stroke of the brush or chain harrows and the land finally rolled again. The mixtures used for permanent pasture naturally vary with the soil-conditions and climate. Standard mixtures suitable for various conditions are to be found in the Department's Bulletin No. 107, "Grasslands of New Zealand." Advice required about grass mixtures for particular conditions should be sought from the district Instructors in Agriculture.

On good ploughable land in the humid parts of New Zealand the ultimate sward of a pasture probably depends more on management than on the original mixture of grass-seed sown. Cocksfoot and rye-grass form the basis of all mixtures sown on good ploughable land, and the final establishment of a good permanent rye-grass, cocksfoot, and clover pasture depends very largely on the methods followed in top-dressing, stocking, chain-harrowing, and mowing. A permanent grass mixture that has been used for a considerable time on the Ruakura Farm of Instruction, and one that has given excellent results and should prove useful for most Waikato district land, is as follows: Italian rye-grass, 4 lb.; perennial rye-grass, 8 lb.; cocksfoot, 12 lb.; crested dogstail, 2 lb.; timothy, 2½ lb.; meadow-foxtail, 1 lb.; white clover, 1 lb.; red clover, 4 lb.; Lotus major, ½ lb.: total, 35 lb.

This mixture is not so heavy as many that are used locally for sowing permanent pastures, but the comparatively light rye-grass seeding that is used enables all the other species sown to become well established. Good subsequent management causes the rye-grass to stool out and grow vigorously and take a prominent place in the pasture sward. A heavy rye-grass seeding is liable to check the early establishment and growth of cocksfoot, dogstail, and timothy, and may not finally give as good a rye-grass sward as a lighter seeding. The seeds of cocksfoot, paspalum, and meadow-foxtail vary considerably in germination, and only first-class lines of seed should be purchased. Good cocksfoot-seed should germinate over 80 per cent.; the average germination is about 65 per cent., and lines will be found that germinate below 40 per cent. Meadow-foxtail seed varies considerably in germination, and 35 to 50 per cent. can be considered good. The germination of paspalum-seed is generally low, and 35 per cent. can be looked on as satisfactory.

HARVESTING OF RED CLOVER AND LINSEED.

Red clover is usually cut for seed about three months after the hay crop. When the clover-seed can be rubbed out from the majority of the heads, and the stalks begin to lie at an angle of 45 degrees, it is time to cut. The crop is cut either with a side-delivery mower or with an ordinary mower fitted with a temporary platform behind the cutter-bar. In the latter case steel bands are fitted to trail behind the mower; the driver of the mower uses an improvised seat—half a sack of chaff

being a handy method. The mower-seat should be turned back to front. A second man sits on this and guides the clover cut into heaps, which lie clear of the wheel in the course of the next cut. By this system the clover may be left in windrows without any trouble. If the material is exceedingly dry it may often be threshed immediately after stacking, before the stack begins to sweat. However, it is frequently the case when the clover is stacked that many of the heads are somewhat immature, and hence a certain amount of curing in the stack is essential. Once a stack starts to sweat it should be left for a month to six weeks before threshing is attempted.

The linseed crop will be ready for harvesting early in March. The crop is ready to cut when the cobs, if rubbed between the hands, open easily and shed the seed. The crop should be allowed to remain in the stook till sufficiently dry; this will take from two to three weeks. The crop is most conveniently threshed from the stook.

— *P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.*

THE ORCHARD.

SPRAYING OPERATIONS.

ATTENTION must still be given to the later varieties of apples that will not be picked for some time. The hot, dry weather experienced will be conducive to various pests in the orchard, and red mite will probably be on the increase. If nothing is done for its control this pest multiplies very rapidly — not only detrimentally to the fruit in the current season, but to the production of strong healthy buds for the next season. Lime-sulphur sprayed at strength of about 1–120 will help to keep red mite in check, although Black Leaf 40, 1–800 or 1–1,000, has been proved to give better results. Owing to the high cost of Black Leaf, some growers have been using red oil, strength 1–160, or a 2-per-cent. kerosene emulsion, both sprays having been found satisfactory for the control of red mite and leaf-hopper. When spraying for these pests it is advisable to direct attention to the under-surfaces of the foliage as much as possible, using considerable force to drive the spray to every part.

Stone-fruit growers are advised to give their trees a good application of bordeaux as soon as possible after the fruit has been picked. This will act as a preventive against the overwintering of spores, and thus reduce the trouble from fungous diseases next spring. Any fruits affected with brown-rot left on the trees or lying on the ground should be gathered up and destroyed.

MARKETING.

The importance of care in the marketing of fruit, whether for local or overseas markets, cannot be too strongly emphasized. The placing of the rejects from export on the local market is detrimental, and causes dissatisfaction among the buying public. These fruits have not reached the proper stage of maturity for local consumption, and very rarely fetch satisfactory prices. If more discrimination were shown when picking, much of this trouble would be eliminated. Where it is intended to cater for the local market it would be preferable to reserve certain trees in the orchard for that purpose, picking the fruit at the

proper stage of maturity and placing it on the market in the very best of condition. The fact that apple-trees should be picked over two or three times is not always realized, with the result that many fruits picked in the early stages are much below the minimum size allowed for that variety. These are put on the local market, with the result as stated above. If left on the tree for a second picking they would size up to the requirements for export, and if too mature for export would be in proper condition for the local market.

The handling of fruit for the local market leaves much to be desired. It should be remembered that there is always a good demand for the best, and the grower who sets a standard and consistently keeps to that standard will soon become known to the buyers, who in turn will always be prepared to give a satisfactory price for the fruit. No fruit with bruises, disease, broken skin, or other blemishes detrimental to its quality should be included. The cases should be well packed with good, sound fruit of uniform size, and neatly stencilled, giving all necessary details. It is only by attention to these several points that the local market can be successfully fostered.

—*G. Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

Owing to the extremely dry weather experienced this summer trees are backward in development, and little could be done to assist them except where irrigation was possible. In order to minimize as much as possible the ill effects of this drought it will be well to put into action all possible cultural practices during the coming autumn. After the first rainfall the soil should be cultivated to break the surface, otherwise the full benefit of the succeeding rains will be lost, as much will run away.

The trees may be expected to make more vigorous autumn growth than usual, and this should be attended to by pinching and spacing, in order to ensure that the growth may be reasonably hard to withstand the frosts to be expected later. It is in winters following such seasons as the present one that winter-kill of tips is most damaging, mainly because the growth is soft.

Autumn manuring also has a bearing on the texture of the growth, and highly nitrogenous fertilizers should be sparingly used. Most trees will, of course, require an autumn dressing, but the most suitable this year should be phosphates and potash, with slower-acting nitrogen such as blood-and-bone.

This is a good season of the year for examining and trimming all trees, removing old and worn-out parts and branches which have a tendency to sweep the ground.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CULLING.

THE coming month marks an important period in the poultry-keeping year. It is then that the culling of undesirable stock should be carried out. Having regard to the high prices now ruling for wheat and other foodstuffs, there should be no delay in weeding out all birds of the

drone type which give signs of not being future profit-makers. It will seldom pay to keep a bird for a third laying season unless, of course, it is known to be a noted layer of standard-weight eggs (2 oz.), and at the same time possesses strong points indicative of breeding-power. Not only should the birds that are terminating their second laying season be heavily culled, but the first season's layers also should be carefully gone through, as many of these may usually be removed with distinct advantage.

The rule has already been stated in these notes that the early moulting bird is the first one to cull. As is the case, however, with most rules pertaining to the management of poultry, this one is not capable of universal application. The fact of a bird moulting early is not always an indication that it has passed its profitable period of production. A premature moult is often the result of a sudden change of food, or failure to provide a palatable diet and sufficient of it—a factor essential to heavy egg-production at this period of the year. Individual birds may also be forced into a premature moult by being allowed to sit on the nest for days and weeks at a time in a state of broodiness. In such circumstances the early-moulting rule is of little value. The same may be said where first-, second-, and third-year layers are allowed to run together, and the common mistake made of neglecting to have the birds specially marked as a guide to age determination. In such cases it will usually be found that the first-season layer moults first, especially when hatched in the early season, and where the older birds have been maintained on the plant merely because they were late moulters.

It will thus be seen that efficient culling can only be carried out where the whole of the local circumstances are closely observed and taken fully into account when the work of classifying the stock is taking place. Of course, on well-managed plants, and where the owner has a trained eye, he can tell with a great degree of certainty (by certain signs in combination with the moulting-period) the hens that have laid well and that are likely to lay well in the future. This enables him to weed out the low producers and thereby keep only profitable stock.

All things being equal in regard to the time of hatching, and where the birds have received a uniform class of food and attention, the good layer and the one which possesses strong constitutional vigour will usually, in addition to being a late moulter, present the following desirable signs: Face large and free from feathers (it is not uncommon for the head to become quite bare—a sign seldom or never found in a low producer); a bold, bright eye; close feathering; a bright red comb (which should be retained more or less throughout the moulting-period); well-developed crop; and an alert, vigorous appearance.

In yellow-skinned breeds such as Leghorns, Wyandottes, Plymouth Rocks, &c., the legs as well as the beak of the good layers will mostly exhibit at this period of the year a bleached or even a white appearance. It must be noted that this sign only applies towards the end of the bird's productive period, for after it has moulted the legs will regain their yellow appearance as in the early pullet stage. The heavy layer will also have a more or less shabby appearance and a lean condition. On the contrary, the poor layers and others which should be culled are those that are moulting, those with bright yellow legs, those

above the normal weight of their breed, those with feathered face and dull eye, and any which show the slightest weakness in constitution.

SELECTION OF THE BREEDING - HENS.

After the weak types have been weeded out, the remaining birds should be carefully gone through and the best specimens selected for the breeding-pens next season. It is important that this work be carried out before the birds moult, as even with the best layers the points outlined as indicative of producing power and constitutional vigour will rapidly vanish as the moulting process advances; furthermore, these points will not stand out prominently again for several months later. In selecting prospective breeding-hens laying and constitutional points should be given first consideration, but these should be combined with good size of body and breed type—that is to say, if desirable utility characters are to be maintained. However well a bird may lay, it should not be bred from if it is an undersized specimen of its breed, or one which is practically devoid of standard breed-requirements.

When the best breeding specimens have been chosen they should be specially marked and kept by themselves, preferably on a free range. Then by providing a plain ration the birds will be discouraged from laying. This will give them an opportunity to recoup and get into a condition to produce early spring eggs, and at the same time retain strong breeding-power. The fact cannot be emphasized too strongly that the greater the demand made on a bird for egg-yield the greater the care that must be exercised not to impair its vigour in the process. It stands to reason that when every egg is forced out of the late moulter and intended breeder everything is against vigorous progeny being produced. Constitution is the base of all successful breeding operations.

COLDS AMONG THE STOCK.

Usually at this time of year many birds contract colds, especially the young stock which have been hatched late. Therefore a careful watch must be kept in order to detect any of the birds showing the first symptoms, such as sneezing, running at the nostrils, or eyes watering. If any of these symptoms are observed the affected birds should be isolated at once, and an endeavour made to find the cause and have it removed. It is next to useless trying to stamp out colds by curative methods unless the cause is first discovered and removed.

Draughty houses are no doubt the most common cause of colds. If there are cracks in the sides or back wall, and the birds are compelled to sleep in a draught, colds are simply invited. In this connection, and where long houses are in use, the necessity of having the partitions, especially near by the roosts, absolutely draught-proof cannot be too strongly urged. Colds may also be brought about by ill-ventilated, damp, or overcrowded quarters. If trouble is to be prevented these and other such weaknesses should be corrected at the earliest possible time. It must be remembered that colds are the forerunner of roup, and if this once obtains a foothold there is no telling when it is going to be stamped out.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

REQUEENING.

ATTENTION must be given in the autumn to replacing queens which are found to cease breeding early in colonies in normal condition with ample food. In all probability they are too old or have been injured in some way. In any case they require to be superseded as soon as possible by young queens. It is a good plan to rear as many queens as possible and have them cared for in nucleus colonies, later to be introduced to full colonies where needed. It is in the spring that young queens reared in the autumn prove so valuable. Their laying-powers are at their best, consequently the colonies build up rapidly; moreover, there is less tendency for the bees to swarm.

AUTUMN FEEDING.

In some districts after the main honey-flow is over a fair amount of nectar is gathered, sufficient to keep the bees breeding and for them to store a little surplus. However, where weather conditions are not favourable the colonies' needs may require to be supplemented in order to promote late breeding. Too often beekeepers are tempted to extract too close when making the final extraction; consequently the sudden curtailment in the food-supply checks breeding, and the colony goes into winter weak in young bees. The amount of stores in the hives is of paramount importance, and the first thought of the beekeeper in the autumn should be that of food-supply. There should be at least 30.lb. to 40 lb. of honey in each hive; and where there is this quantity or more and it appears to be diminishing rapidly the colonies should be additionally fed. It must be remembered that it is in the autumn that the beekeeper lays down the foundation for his next season's crop; consequently he must concentrate on wintering his bees in the best condition possible.

ROBBING.

During the next month or so, with very little or no honey-flow, bees are likely to rob the weaker hives. Do not encourage this by exposing combs, honey, syrup, &c. Contract the entrances of the weaker hives, as this gives the inmates a better chance to protect themselves. All operations with the hives should be performed expeditiously, and if feeding is necessary carry out this operation late in the afternoon, and then with every precaution to keep the bees quiet. If robbing should start, all operations in the apiary had better cease. Contract the entrances of the hives being robbed, and throw wet grass or weeds loosely on the alighting-boards so as to prevent the entrance of the robbers. If robbing cannot be checked in this way it may be advisable to shift the colony to another situation in the apiary.

UNITING WEAK COLONIES.

It is well to make a note of any weak colonies and any that are not doing well, as these are likely to succumb during the winter and early spring. It is by far the better plan to unite them with others rather than winter them, as they frequently become a prey to robbers, and are in that case a danger. A simple method of uniting may be practised by placing the weaker hive on top of a stronger one and

placing a sheet of newspaper between the two hive-bodies. In the course of a few days the bees in the weaker hive will eat their way through the paper and unite peaceably with the bees in the stronger colony.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO CROP.

BRIGHT tobacco as it comes from the flue barn requires careful and experienced handling, or it quickly depreciates in quality. The proper method after curing is to condition the leaf—that is, to bring it to a soft pliable state in which it may be handled without breaking, and to approximately grade the leaves for colour. On a platform a foot or so above the floor in the bulking or grading room the leaves are then carefully stacked (" bulked " is the usual term) with the butts outwards, any convenient length and width, and 5 ft. to 6 ft. high. The natural result is for the stack to heat, and during the process a careful watch is kept to make sure the temperature does not rise too high. Should it rise much above 80° F. the material is taken down and rebulked, the leaf from the inside being placed towards the outside of the new bulk. After the completion of this process the leaves are carefully graded into classes of bright, medium, and dark colour, tied into hands, and packed for the market.

This is a general outline of the processes often adopted in the handling of flue-cured leaf ; but for commercial purposes the judgment necessary for determining the right condition of the leaf, proper grades, and suitable humidity and temperatures can only be acquired by practical experience under the personal tuition of an instructor with a properly equipped plant.

In the case of air-cured tobacco the process is simpler. Instead of one week, some six weeks are necessary to complete the cure. As the cooler weather arrives, care is necessary to prevent the leaf being chilled by cold and damp, which are apt to set up mildew. For this reason harvesting should proceed with as little delay as possible.

TOMATOES.

The weather, so unpropitious for the outdoor tomato crop at the beginning of the season, has since been better for this crop, and those who nursed their plants successfully through the bleak conditions of early summer should now be receiving their well-earned reward.

Potting-soil for next season should now be stacked and matured. In some instances it will have been already twelve months in the stack. If it has not already been prepared, this should be done at once, or trouble in the seed-boxes is inevitable. Better still, increase the quantity and lay in a stock for 1929 also. Such methods are the easiest and cheapest way of overcoming most of the diseases to which young seedling plants are liable.

SMALL-FRUITS.

The demand for Cape gooseberries and passion-fruit is steadily increasing, and the crops now being gathered should find a ready

market. Both of these useful plants are from Peru or thereabouts, as are so many others of our most useful economic plants.

If the old canes of raspberry and loganberry brakes have not yet been cut out and burnt, this should be done now. Also crowded young growth in red and white currants and gooseberries should be thinned, the idea being to ripen the remaining wood and spurs in readiness for the next season's crop. This is also the best time to deal with most diseases which affect these crops. Spraying will be the best method, although the advantage of turning in a flock of poultry for a period now and again at this season is worth consideration in many instances. The destruction of many insects and larvæ is only one of the economic benefits derived from this practice. Where organic manures are not available in sufficient quantity, a good dressing of bonedust down the alleys and a sowing of a quick, hardy, green cover-crop would now be of great benefit.

Where new plantations of bush fruits are to be made, the preparation of the land should be given every consideration, as results chiefly depend on a rich, deep, clean tilth ; once the plants are established only shallow ploughing can be given. It is best to give this early attention, so that the land may settle down in time for planting in early winter.

VEGETABLE CROPS.

The winter crop of savoy, cauliflower, broccoli, celery, and leeks should now be well established. It should be remembered that the last two especially require generous feeding in order to produce the best results. As celery takes about six weeks to blanch, and this operation should be completed before hard frosts commence, a commencement may be made now by moulding the crop up slightly. The work should be completed in about three operations with intervals of a week or fortnight in between.

The seed-beds of spring cabbage and cauliflower should be watched, so that good plants may be ready for planting out next month. Complete the preparation of the land for them now by frequent hoeing to kill all seedling weeds.

In districts where it is necessary to sow main crop and white onions in the autumn for transplanting in early spring, the beds should now be prepared and sown down. Select a piece of clean land in a good open position. If manures are required, apply a moderate dressing of bonedust, wood ashes, and soot, and turn this in before firming the ground for sowing.

THE HOME GARDEN.

The month of March is the best time for sowing down lawns and greens, especially in the drier localities. Before doing so care must be taken to see that the land is clean and firm with an even surface. As the success of the work depends chiefly on this preparation it should not be hurried, but completed with the greatest care. A moderate tilth should then be made by raking the surface, and the seed sown when no wind is blowing. If it is then raked in evenly the job will be finished until the grass is ready for cutting in six to eight weeks' time.

Where planting has to be done the selection of trees and shrubs should now be completed, and the order given to the nurseryman for

delivery in the month of May. As before stated, planting of this kind is often unsuitable and too varied. If careful study is given to plans—and the permanent character of the work demands it—there is no reason why it should not be harmonious and original. Nowhere else in the world is nature more kind in helping the gardener to make gardens of taste and beauty.

In gardens where native plants predominate the association of hydrangeas and fuchsias in the excellent varieties now available have been admirably demonstrated lately. They are effective in providing suitable summer bloom in the partly shaded sections of the garden which the native plants do not provide. Among a few natives too rare in our gardens is kaiku (*Parsonsia heterophylla*), the New Zealand jasmine, a hardy climber that is found growing at the foot of the ramarama (*Myrtus bullata*) or other small tree, up which it twines and displays its scented flowers in spring among the foliage of its host. It appears to be a happy combination that is mutually satisfactory.

We are inclined to be rather apologetic about our native orchids, but here are two that deserve high praise in any company: Raupeka (*Earina suaveolens*) is a hardy winter-flowering species sometimes found on steep clay hills partly shaded by bush, growing in a little soil and leaf mould that has formed a drift in the fine network of the roots of some ground fern. Wet or dry it seems quite happy, as in summer often its roots appear so dry that most plants would wither up. In a similar position, and sometimes together, will be found *Dendrobium Cunninghamii*, a summer-flowering orchid, its curved wiry stems and small foliage having all the grace of the popular asparagus grown in hanging-baskets; but to these attractions it adds its much larger and curious flowers. These two orchids are admirably adapted for hanging-baskets on the veranda, the walls of a fernery, or a place in a partially shaded rock-garden.

—*W. C. Hyde, Horticulturist, Wellington.*

AGRICULTURAL SHOWS, SEASON 1927-28.

THE following show-dates, for the remainder of the current season, have been notified by agricultural and pastoral associations:—

Franklin A. and P. Association: Pukekohe, 24th and 25th February.
Waiapu P. and I. Association: Pastoral Show, Ruatoria, 25th February.
Tauranga A. and P. Association: Tauranga, 29th February.
Hukerenui Agricultural Association: Hukerenui, 1st March.
Mongonui County A. and P. Association: Kaitaia, 3rd March.
Opotiki A. and P. Association: Opotiki, 6th March.
Morrinsville A. and P. Society: Morrinsville, 7th March.
Taranaki Agricultural Society: New Plymouth, 7th and 8th March.
Matamata A. and P. Association: Matamata, 13th March.
Hawke's Bay A. and P. Society: Autumn Show, Tomoana, 14th March.
King-country Central A. and P. Association: Te Kuiti, 15th March.
Kaikoura A. and P. Association: Kaikoura, 16th March.
Mayfield A. and P. Association: Mayfield, 17th March.
Hawarden A. and P. Association: Hawarden, 23rd March.
Temuka and Geraldine A. and P. Association: Geraldine, 27th March.
Methven A. and P. Association: Methven, 29th March.
Oxford A. and P. Association: Oxford, 5th April.
Flaxbourne A. and P. Association: Ward, 19th April.

TESTING OF PUREBRED DAIRY COWS.

JANUARY CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE January C.O.R. list is a comparatively small one; by that period the majority of the cows on test in the previous season have calved and qualified for their certificates.

While the appended details of performance include particulars of a number of good yields, the most interesting feature of the list is the production of the Milking Shorthorn cow Rangataiki 2nd, owned and tested by Mr. G. N. Bell, of Karere, Longburn. According to her owner this remarkable animal was born in 1902, and was some 24 years 248 days old at commencement of test. Mr. Bell advises that she dropped her twenty-fourth calf on 5th November last, and is giving over 4 gallons of milk per day. In view of her age her last year's authenticated production of 10,688·1 lb. milk containing 376·72 lb. butterfat, in 335 days, is a distinct achievement.

Rangataiki 2nd is stated to be a representative of the good old type of English Milking Shorthorn, and, accepting the definition of constitution as "the ability to continue to the end within the line and limitation of purpose," this cow surely evidences good constitution to a marked degree.

LIST OF CERTIFICATES ISSUED, JANUARY, 1928.

* Cow milked three times daily during whole lactation period † Milked three times daily during part of period.

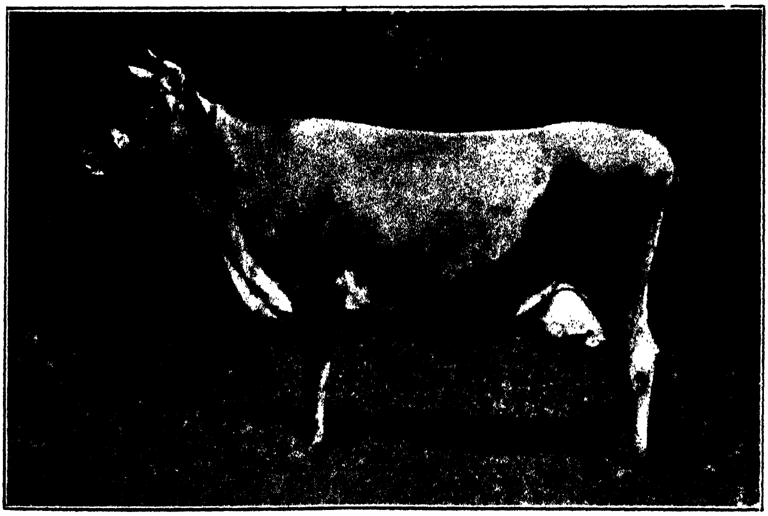
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Waiuku Dawn ..	W. Craig, Waiuku ..	2 92	249·7	365	10,023·7	630·68
Waipiko Lovebird ..	C. G. C. Dermer, Waipiko ..	2 44	244·9	365	9,908·9	557·49
Ngahiwi's Grand Queen	W. J. Freeth, Waitara ..	2 5	241·0	364	9,197·8	525·08
Takapau Peggy ..	R. C. Jury, Tikorangi ..	2 14	241·9	365	8,371·4	487·76
Wattle Grove Pansy..	W. Robinson, Patumahoe ..	1 138	240·5	365	6,703·4	429·13
Oaklands Colleen ..	C. G. Aickin, Auckland ..	2 33	243·8	365	5,334·7	351·30
Holly Oak Osier ..	C. G. Aickin, Auckland ..	1 299	240·5	365	5,035·1	316·76
Senior Two-year-old.						
Gowanlea Silent Lass	J. Campbell, Katikati ..	2 363	276·8	365	8,124·4	509·47
Ku Ku Primula ..	W. Devine, Palmerston N.	2 333	273·8	365	8,281·0	373·38
Three-year-old.						
Waipiko Jewel ..	C. G. C. Dermer, Waipiko ..	3 207	297·7	311	9,393·2	520·73
Four-year-old.						
Waikari Silver Queen	L. A. Higgins, Belgrove ..	4 16	315·1	365	11,020·7	513·42
Holly Oak Kewpie ..	A. J. Hale, Hillsborough ..	4 55	319·0	365	8,883·4	502·89
Mature.						
Crofton Countess ..	R. C. Jury, Tikorangi ..	5 356	350·0	365	13,077·4	812·34
Alfalfa Pansy* ..	F. P. King, Hautapu ..	6 93	350·0	365	12,606·0	736·12
Lady Lily Warrigal ..	J. T. Belcher, Cardiff ..	5 57	350·0	365	12,549·3	727·73
Tinsel's Lady Twylish	E. Hofmann, Matatoki ..	5 336	350·0	365	10,820·3	613·07

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
		JERSEYS—*continued.*					
Mature—continued.		Yrs.	dys.	lb.		lb.	lb.
Springdale Fidel ..	J. A. Blake, Waipawa ..	5	98	350·0	365	9,592·5	563·63
Tinsel's Lady Clarabelle	E. Hofmann, Matatoki ..	5	27	350·0	365	11,608·1	526·50
Yankee Pet ..	R. C. Jury, Tikorangi ..	6	335	350·0	365	9,089·5	520·87
Fernaig Emily ..	C. G. Aickin, Auckland ..	7	86	350·0	365	8,851·1	512·39
Onaero Waif ..	J. T. Belcher, Cardiff ..	5	98	350·0	365	8,244·2	477·06
		FRIESIANS.					
Junior Two-year-old.							
Rosevale Queen Daphne Triumph*	North and Sons, Omimi ..	2	142	254·7	365	15,887·5	593·48
Willowburn Daisy Pietertje*	R. J. Potter, Pukerau ..	2	92	249·7	365	15,224·5	519·27
Ryvington Pontiac Mercedes†	Hodgson Estate, Tamahere	2	16	242·1	365	12,594·4	422·84
Ryvington Pontiac Pietje†	Hodgson Estate, Tamahere	2	45	245·0	296	10,096·8	359·30
Senior Two-year-old.							
Rosevale May Echo Beets*	North and Sons, Omimi ..	2	358	276·3	365	17,070·1	614·46
Bloomfield Elgin Mabel*	Bloomfield Farm Co., Wellington	2	350	275·5	365	13,580·8	458·79
Anawhata Hilda Minto Pietertje	P. F. Boucher, Kumeu ..	2	318	272·3	231	8,242·9	318·93
Junior Three-year-old.							
Bainfield Princess Daisy Bell*	Piri Land Co., Auckland ..	3	105	287·5	365	15,161·7	617·46
Senior Four-year-old.							
Cornucopia Pontiac Paxton†	Hodgson Estate, Tamahere	4	272	340·7	291	15,132·0	455·74
Mature.							
Rosevale Sylvia Triumph*	North and Sons, Omimi ..	5	88	350·0	365	20,568·7	625·74
Rosevale Burkeyje Sylvia*	North and Sons, Omimi ..	9	66	350·0	365	17,248·1	617·69
Rosevale Topsy Abbekirk*	North and Sons, Omimi ..	6	294	350·0	365	17,479·8	594·21
Rosevale Cora Posch*	North and Sons, Omimi ..	5	314	350·0	365	17,326·9	577·31
Rosevale Model Sylvia*	North and Sons, Omimi ..	6	40	350·0	342	14,791·1	494·43
Hauraki Ideal ..	W. A. Kyle, Palmerston N.	8	115	350·0	312	11,314·6	419·02
		MILKING SHORTHORNS.					
Two-year-old.							
Mereside Sweet Pea ..	W. Bowis, Doyleston ..	2	40	244·5	318	5,662·2	246·96
Senior Three-year-old.							
Brae Bank Lady† ..	W. J. Holmes, Tuhimata ..	3	274	304·4	328	9,929·6	368·55
Senior Four-year-old.							
Willowbank Tangi's Sunshine 2nd†	W. J. Holmes, Tuhimata ..	4	317	345·2	349	11,402·2	440·11
Birkland Babs ..	G. N. Bell, Karere ..	4	285	342·0	298	10,454·0	412·47
Willowbank Tangi's Dolly†	W. J. Holmes, Tuhimata ..	4	303	343·8	343	8,814·1	402·51

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	MILKING SHORTHORNS—*continued.*						
Mature.		Yrs.	dys.	lb.		lb.	lb.
Homestead Model ..	G. N. Bell, Karere ..	17	34	350·0	365	14,475·0	613·29
Greenfields Strawberry 2nd*	W. J. Holmes, Tuhimata ..	6	168	350·0	365	12,998·3	605·70
Dominion Lucilla of Ruakura†	R. S. Allan, Hatuma ..	6	0	350·0	353	12,668·3	505·93
Braeside Lady Wallace 2nd†	W. J. Holmes, Tuhimata ..	7	112	350·0	344	12,242·1	444·70
Rangataiki 2nd ..	G. N. Bell, Karere ..	24	248	350·0	335	10,688·1	376·72
	AYRSHIRES.						
Two-year-old.							
Glengyle Snowflake ..	McAdam Bros., Queenstown	1	338	240·5	365	7,389·5	349·60
	Second-class Certificates.						
	Jerseys.						
Junior Two-year-old.							
Ku Ku All Gold ..	R. L. Horn, sen., Ohau ..	1	301	240·5	365	9,843·9	486·21
Mature.							
Parakau Gem ..	G. E. Yelchich, Waiuku ..	7	34	350·0	365	12,439·1	754·51
Dulciphone ..	A. J. Hale, Hillsborough ..	6	347	350·0	365	14,005·7	725·73
	Friesians.						
Mature.							
Dominion Mierlo Mercedes	Central Development Farm, Weraroa	6	20	350·0	365	17,514·2	560·03



LADY LILY WARRIGALL (J. T. BELCHER, CARDIFF).

C.O.R., 1927, in Jersey mature class: 12,549·3 lb. milk, 727·73 lb. butterfat.

EXPORT OF APPLES AND PEARS, 1928 SEASON.

1. CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee on shipments of apples and pears made from New Zealand during the 1928 export season are as follows:—

1. The guarantee shall be limited to approved varieties and classes of apples and pears packed in compliance with the requirements of "Extra Fancy" and "Fancy" grades.

2. The Government guarantees to the grower a gross market price of eleven shillings (11s.) per case on all cases of such apples and pears exported by him in accordance with the conditions set out herein. (With respect to South American markets the gross price shall be considered to be the c.i.f. price, plus 1s. 6d. per case selling-charges.)

3. The guarantee shall be limited to apples and pears grown and shipped (otherwise than under an f.o.b. contract), by *bona fide* fruitgrowers or fruitgrowers' co-operative societies, through the New Zealand Fruit-export Control Board or other channels approved by the Minister of Agriculture.

4. Any grower who exports any portion of his fruit crop outside the guarantee shall be deemed to have forfeited his right to participate in the guarantee with respect to all fruit exported during the season by him or on his behalf, save that any grower, if he so desires, may ship the whole of his pears outside the guarantee without prejudice to his apple shipments under the guarantee, and *vice versa*.

5. All apples and pears to qualify for the guarantee must be passed by an Inspector of the Department, and must be packed in accordance with the Export Regulations, subject to the modifications and directions set out in the appended statement entitled "Export Regulations."

6. Payment of claims under the guarantee shall be calculated on the basis of the average gross price per case received by the claimant for the whole of the apples and pears approved under the guarantee and exported on his account during the season to all markets, and only the deficiency between the average gross price realized for such fruit and 11s. shall be payable under the guarantee.

7. Where, however, apples or pears of more than one variety and supplied by more than one grower are exported by a joint packing company or group in its own name, the guarantee shall be calculated separately in respect of the whole of the fruit supplied for export by each grower, on the basis of the pool price received for each variety supplied by him; provided that the joint packing company or group shall have, not later than seven days after the fruit has been shipped from New Zealand, notified to the Director of the Horticulture Division full particulars of each grower's fruit included in each shipment.

8. The Government reserves to itself the right (*a*) to withhold the guarantee from any grower who, in the opinion of the Director of the Horticulture Division, is not satisfactorily grading out, and exporting separately, his "Extra Fancy" and "Fancy" grade fruit; (*b*) to withhold from any grower the guarantee with respect to any variety of "Fancy" grade fruit in the event of the Director of the Horticulture Division being satisfied that such grower is not shipping a reasonable proportion of his "Extra Fancy" grade fruit of that variety; (*c*) to withhold the guarantee from any grower who sells, except for consumption within New Zealand, any portion of his fruit crop without the approval of the Director of the Horticulture Division; (*d*) to limit the quantity of fruit shipped to any particular port should freight rates or market conditions, &c., be deemed unsatisfactory; (*e*) to insist on fruit being precooled prior to shipment if deemed necessary; (*f*) to withhold the privileges of the guarantee from all fruit shipped in vessels the storage facilities of which are held by the Department to be unsatisfactory; (*g*) to withhold the privileges of the guarantee with respect to any market in connection with which the New Zealand Fruit-export Control Board is of the opinion that satisfactory f.o.b. or c.i.f. trade is or can be established; (*h*) to withhold the guarantee with respect to any fruit packed contrary to such instructions as may be issued by the Department of Agriculture, after discussion with the accredited representative of the Fruit Control Board and the shipping agents of the fruitgrowers concerned, calling for a cessation of packing during any specified period, owing to the lack of shipping facilities or other causes.

9. The Government reserves the right to re-examine and to withdraw any fruit from export in the event of such re-examination indicating that by reason of overmaturity or other cause inimical to the keeping-qualities of the fruit it would be inadvisable to allow such fruit to be exported. All fruit so withdrawn may be disposed of in New Zealand by the owner without reference to the guarantee, or by the Government on behalf of the owner. In the latter event the proceeds will be credited to the owner, and the transaction dealt with generally as though the fruit had been actually exported under the guarantee. But should such re-examination reveal the fact that any line of fruit, through careless or faulty packing, is decidedly below the standard required, it will be deemed not to be covered by the guarantee, and the owner of such fruit may, at the option of the Minister, be held to have forfeited all right to participate in the guarantee for the remainder of the season.

(N.B.—No apples or pears carrying more than one hundredth part of a grain of arsenic per pound shall be approved for export under the guarantee or otherwise.)

2. EXPORT REGULATIONS.

The regulations which follow shall apply to all apples and/or pears intended for export.

APPLE GRADES AND VARIETIES.

The standard grades shall be as under :—

"Extra Fancy," "Fancy," and "Good" grades: Apples of these grades shall be mature, sound, smooth, clean, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects. Individual apples of either grade shall carry not less than the percentage of colour, and not more than the percentage of blemish and unnatural russet indicated in the appended general list with respect to each variety in the respective grades.

XF = Extra fancy; F = Fancy; G = Good; GCC = Good characteristic colour; CC = Characteristic colour.

Varieties.	Sizes.			Colour.			Blemish.			Russet.		
	Max.	Min.	Min.									
	XF, F, G.	XF, F	G.	XF. %	F. %	G. %	XF. %	F. %	G. %	XF. %	F. %	G. %
Solid Red.												
Hoover	100	234	252	65	30	30	5	5	5	5	10	20
McIntosh Red ..	113	234	252	65	30	30	5	5	5	5	10	20
Rokewood	113	234	252	65	30	30	5	5	5	5	10	20
Tasma	100	234	252	65	30	30	5	5	5	5	10	20
Partial Red.												
Brighton	113	234	252	40	15	15	5	5	5	5	10	20
Delicious	113	234	252	40	15	15	5	5	5	5	10	20
Dougherty	113	234	252	40	15	15	5	5	5	5	10	20
Edward Lippiatt ..	113	234	252	40	15	15	5	5	5	5	10	20
Frimley Beauty ..	113	234	252	40	15	15	5	5	5	5	10	20
Jonathan	113	234	252	40	15	15	5	5	5	5	10	20
King David ..	113	234	252	40	15	15	5	5	5	5	10	20
Rome Beauty ..	113	234	252	40	15	15	5	5	5	5	10	20
Salome	113	234	252	40	15	15	5	5	5	5	10	20
Scarlet Nonpareil ..	113	234	252	40	15	15	5	5	5	5	10	20
Scarlet Pearmain ..	113	234	252	40	15	15	5	5	5	5	10	20
Shepherd's Perfection	113	234	252	40	15	15	5	5	5	5	10	20
Shorland Queen ..	113	234	252	40	15	15	5	5	5	5	10	20
Spitzenberg	100	234	252	40	15	15	5	5	5	5	10	20
Stark	113	234	252	40	15	15	5	5	5	5	10	20
Worcester Pearmain ..	125	234	252	40	15	15	5	5	5	5	10	20
Yate's	113	234	252	40	15	15	5	5	5	5	10	20

Varieties.	Sizes. Max.	Min.	Min.	Colour.			Blemish.			Russet.		
	XF, F, G.	XF, F.	G.	XF. %	F. %	G. %	XF. %	F. %	G. %	XF. %	F. %	G. %
Striped.												
Adam's Pearmain ..	113	234	252	25	10	10	5	5	5	5	10	20
Cox's Orange ..	125	252	252	25	10	10	5	5	5	5	15	50
Premier	100	234	234	25	10	10	5	5	5	5	10	20
Ribston Pippin ..	125	234	252	25	10	10	5	5	5	5	10	20
Senator	113	234	252	25	10	10	5	5	5	5	10	20
Simmond's Winter ..	113	234	252	25	10	10	5	5	5	5	10	20
Statesman	113	234	252	25	10	10	5	5	5	5	10	20
Stayman's Winesap ..	113	234	252	25	10	10	5	5	5	5	10	20
Yellow or Green.												
Alfriston	88	198	198	GCC	GCC	CC	3	5	5	2	10	15
Ballarat	88	198	198	GCC	GCC	CC	3	5	5	2	10	15
Boston Russet ..	100	234	252	GCC	GCC	CC	3	5	5	2	10	15
Brownlee's Russet ..	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
Cleopatra	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
Celo	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
Dunn's	96	216	234	GCC	GCC	CC	3	5	5	2	10	15
Golden Pippin ..	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
Granny Smith ..	96	234	252	GCC	GCC	CC	3	5	5	2	10	15
Gravenstein ..	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
London Pippin ..	100	216	234	GCC	GCC	CC	3	5	5	2	10	15
Lord Wolseley ..	100	198	216	GCC	GCC	CC	3	5	5	2	10	15
McMahon's White ..	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
Newtown Pippin ..	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
Parlin's Beauty ..	96	198	216	GCC	GCC	CC	3	5	5	2	10	15
Pioneer	113	234	252	GCC	GCC	CC	3	5	5	2	10	15
Stone Pippin ..	113	234	234	GCC	GCC	CC	3	5	5	2	10	15
Sturmer Pippin ..	100	234	252	GCC	GCC	CC	3	5	5	25	50	75
Willie Sharp ..	100	216	234	GCC	GCC	CC	3	5	5	2	10	15

APPROVED FOR EXPORT TO SOUTH AMERICA.

"Extra Fancy" grade apples only shall be approved for South American markets as follows:—

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
	Solid Red Varieties.				
96	Rokewood	125	72	Tasma	125
	Partial Red Varieties.				
72	Delicious	125	96	King David	125
80	Dougherty	125	72	Rome Beauty ..	125
72	Frimley Beauty ..	125	88	Salome	125
96	Jonathan	125	88	Scarlet Nonpareil ..	125
	Striped Varieties.				
80	Premier	125	80	Stayman's Winesap ..	125
96	Statesman	125			

REGISTERED EXPORT NUMBER.

The registered number issued to all growers under the Local-market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit

exported by him, provided that in the event of any group of growers pooling their fruit for export such group may designate its fruit by using any pool number allotted by the New Zealand Fruit-export Control Board. Likewise any packing organization to which a registered number has been allotted may use such registered number only, provided that in either instance each individual grower's fruit is shown separately on the advice-note for examination and stacked in separate lots, so that the Inspector may have no difficulty in identifying the particular lot under examination.

Should unavoidable circumstances prevent the adoption of this procedure, resulting in a line comprising a large number of cases being submitted as one line, it must be definitely understood that the examination of same will be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line will be liable to rejection.

PACKING.

Plain or corrugated strawboard or wood-wool shall be used on top and bottom of cases.

WRAPPING-PAPER.

Apples of the various sizes as set out below shall be wrapped in paper of the size indicated opposite each respectively :—

Sizes 64's to 80's (both inclusive), paper 11 in. by 11 in.

Sizes 88's to 113's (both inclusive), paper 10 in. by 10 in.

Sizes 125's to 198's (both inclusive), paper 9 in. by 9 in.

Sizes 216's to 234's (both inclusive), paper 8 in. by 8 in.

In the event of the size of the paper used being smaller than that specified above for any respective size of apples, such apples shall be double-wrapped by overlapping two papers.

SPECIFICATION OF APPLE EXPORT CASE.

Inside measurements : 10½ in. by 11½ in. by 18 in.

Ends : 10½ in. by 11½ in. by ¾ in., two pieces (each planed on the outer side).

Sides : 10 in. by 19½ in. by $\frac{5}{16}$ in., two pieces (one board for each side).

Tops and bottoms : 5½ in. by 19½ in. by $\frac{3}{16}$ in., four pieces (two each for top and bottom.

Cleats : 11½ in. by ¾ in. by $\frac{5}{16}$ in., four pieces (one across each end both top and bottom).

Cases made of two-piece sides and two-piece ends will be accepted provided the side boards are of equal width and are cut or planed to an equal thickness, and that the grain of the end boards is across the end corresponding with the greatest measurement, and that the two pieces are properly secured by means of corrugated fasteners, one close to each edge on the one side, and one midway between on the reverse side.

Local timber recommended for the construction of export cases is white-pine of good quality ; but *Pinus insignis*, rimu, and beech timber, if well and evenly cut and used with flexible tops and bottoms not exceeding $\frac{3}{16}$ in., will be accepted.

Nailing : Nails used to be not less than 1½ in. long, 14 gauge. Nails to be spaced not more than 3 in. to 3½ in. apart, and the outer nails of each board to be not more than 1 in. from the edge of board.

Strapping : All cases to be strapped with a wire or steel band, such strapping to be tightly applied and to be not more than 1 in. from end of case.

LABELLING AND MARKING.

Each end of each case of fruit intended for export must bear a label of one or other of the designs adopted by the New Zealand Fruit-export Control Board for the purpose of designating " Extra Fancy," " Fancy," and " Good " grades.

The marking of cases shall be in accordance with the previous season's requirements.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NEW ZEALAND
PEARS
397

FIG. 1.


NEW ZEALAND
PEARS
397
NEW ZEALAND
PEARS

FIG. 2.

APPLES PACKED IN TRAYS.

Apples may be packed in trays in a manner similar to that prescribed for the packing of pears, provided that apples ranging in size from 100 to 163 per case of "Extra Fancy" grade only shall be so packed.

PEARS.

The following varieties of pears are approved for export to Europe :—

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
In.		In.	In.		In.
2¾	Elizabeth Cole	2¼	2¾	P. Barry	2¼
2¾	Glou Morceau	2¼	2¾	Packman's Triumph ..	2¼
2¾	Josephine de Malines ..	2¼	2¾	Winter Cole	2¼
2¾	Keiffer	2¼	2¾	Winter Nelis	2¼
2¾	L'Inconnue	2¼	2¾	Vicar of Winkfield ..	2¼

PEAR PACKAGES.

Pears for export shall be packed in wooden trays having an inside measurement of 11½ in. by 18 in., with depth from 2½ in. to 3 in. Each tray to be complete with lid and label. Three trays to be securely wired together, forming one package. Binding-wires to be placed within 1 in. of each end of the package.

It is essential to the safe carriage of pears that the tray in all cases should be at least ¼ in. to ½ in. deeper than the greatest width of the fruit. Abundance of soft wood-wool should be used above and below the fruit. A cleat may be placed under the lid at each end when it is found necessary to increase the depth of a pear-tray.

Specifications of Trays in Sets of Three.

Ends: 11½ in. by 3 in. (or 2½ in.) by ¾ in., six pieces.

Sides: 19½ in. by 2¼ in. by 5/16 in., six pieces.

Tops and bottoms: 19½ in. by 5½ in. by 5/16 in., four pieces.

Tops and bottoms: 19½ in. by 5½ in. by 3/16 in., eight pieces.

Cleats: 11½ in. by ¾ in. by 5/16 in., four pieces.

In the construction of trays on the basis of sets of three to the package the following is recommended: Bottom of bottom tray and top of top tray to be of two pieces, each 5½ in. by 5/16 in. Tops and bottoms in all other instances to be of two pieces, each 5½ in. by 3/16 in. Middle tray to have cleats across each end both top and bottom, thus requiring four cleats ¾ in. by 3/16 in. by 11½ in. Constructed in this way any bulge that takes place is inward, owing to the timber being lighter than the outer tops and bottoms. At the same time any such bulge is protected by the cleats, which also keep the trays apart, thus allowing for free ventilation.

LABELLING PEAR-TRAYS.

The same type of label will be used as was used last season (1927), but one end only of each tray will be required to bear a label, the other end to have the shipping number stencilled thereon.

After being packed and labelled, three trays will be wired together as one package of three trays, the centre tray to be turned the reverse end to the other two, thereby ensuring that the shipping number and other details will be shown on both ends of the package. (See Figs. 1 and 2.)

MINIMUM CONSIGNMENT.

Twenty cases of any one variety of either apples or pears shall be the minimum consignment accepted for export.

WEATHER RECORDS: JANUARY, 1928.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows :—

GENERAL NOTES.

The past month of January has been notable for the exceptionally dry conditions experienced over the whole of the Dominion. The deficiency of rainfall is most serious in districts with a westerly aspect, following as it does on a dry December.

No vigorous low-pressure disturbance affected any part of the New Zealand region during the course of the month. On several occasions storms developed in Australia which would normally have brought general rains to this country. In each instance, however, although some slight effect was felt, the pressure changes were reduced to shallow waves by the time the disturbance crossed the Dominion. The most important of these waves passed on the 1st 2nd and the 26th January respectively. Each produced moderate rains in parts of the west coast districts, with scattered showers elsewhere.

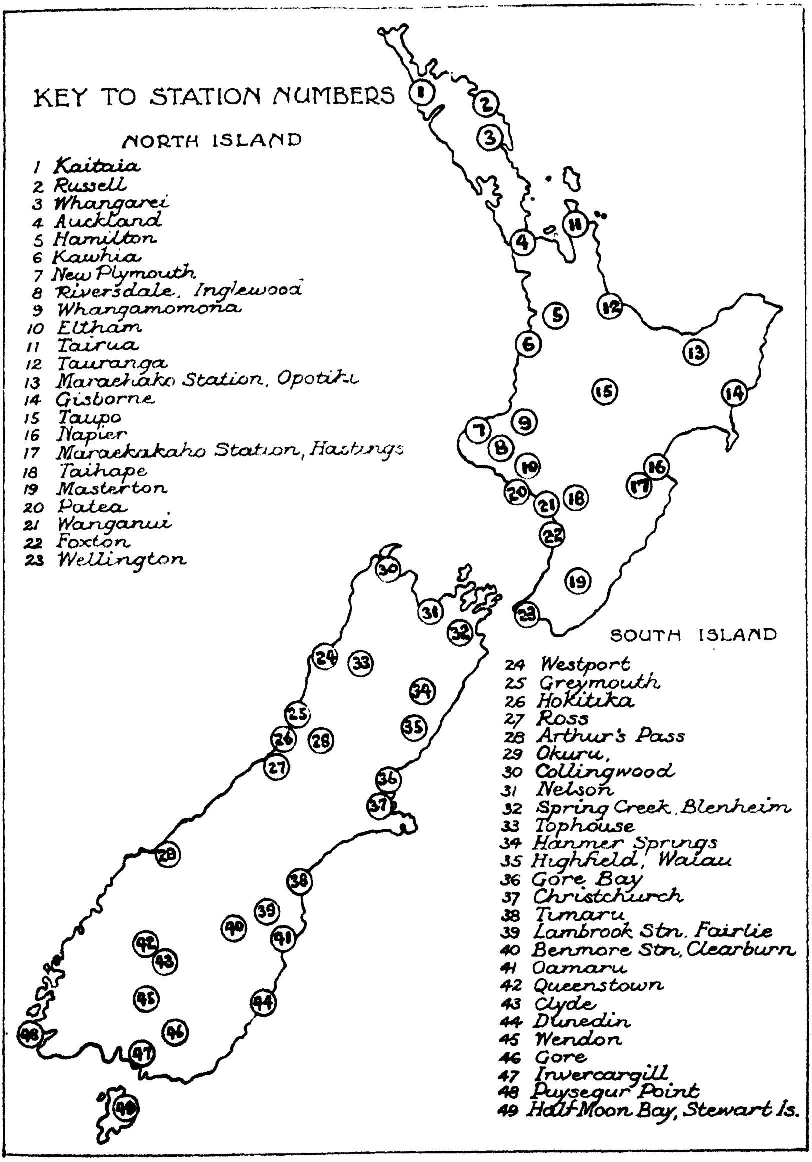
The dominant feature of the pressure distribution has been the persistence of high pressure, especially in the North. Anticyclones were actually centred over or near New Zealand on 1st–2nd, 4th–6th, 8th–12th, 14th–23rd, and 29th–31st respectively. The dry, warm, sunny, and droughty weather experienced was the direct consequence of these anticyclonic conditions. The mean pressure was the highest recorded for January at Wellington.

On the whole there has been a relative absence of wind, but between the 16th and 19th, while a rather intense anticyclone lay across the South Island, strong easterly winds blew over the North Island, frequently reaching gale force in the far North and causing showery weather in the Auckland Peninsula.

The month has been the driest January on record in southern Auckland, Taranaki, and parts of the Manawatu, Nelson, and Marlborough districts.

RAINFALL FOR JANUARY, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average January Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	0·22	4	0·10	3·30
2	Russell	1·72	9	0·49	4·11
3	Whangarei	1·52	9	0·66	4·08
4	Auckland	0·20	3	0·13	2·66
5	Hamilton	0·15	..	..	3·94
6	Kawhia	0·11	2	0·09	3·52
7	New Plymouth	Nil	..	..	4·42
8	Riversdale, Inglewood ..	0·03	2	0·02	7·43
9	Whangamomona	Nil	..	..	6·05
10	Eltham	0·01	1	0·01	3·92
11	Tairua	0·30	4	0·10	4·35
12	Tauranga	0·17	4	0·09	4·34
13	Maraehako Station, Opotiki	0·38	2	0·28	4·29
14	Gisborne..	1·27	4	1·09	2·97
15	Taupo	0·50	1	0·50	3·71
16	Napier	0·35	5	0·21	3·18
17	Maraekakaho Stn., Hastings	0·47	8	0·24	2·29
18	Taihape	0·32	2	0·26	3·28
19	Masterton	0·57	6	0·47	2·69
20	Patea	0·01	1	0·01	3·79
21	Wanganui	0·01	1	0·01	2·87
22	Foxton	Nil	..	..	2·30
23	Wellington	0·19	5	0·11	3·31



MAP SHOWING NEW ZEALAND RAINFALL STATIONS COMPRISED IN JOURNAL LIST.

RAINFALL FOR JANUARY, 1928—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
	South Island.				
		Inches.		Inches.	Inches.
24	Westport	2·89	6	1·99	6·80
25	Greymouth	2·81	5	0·95	9·03
26	Hokitika	4·98	7	2·18	9·87
27	Ross	5·20	5	2·53	12·04
28	Arthur's Pass	0·90	2	0·82	9·36
29	Okuru, Westland	7·46	5	2·15	12·86
30	Collingwood	0·14	2	0·12	6·95
31	Nelson	Nil	..	..	2·82
32	Spring Creek, Blenheim	0·02	1	0·02	2·22
33	Tophouse	0·59	3	0·40	5·14
34	Hanmer Springs	1·31	6	0·47	3·74
35	Highfield, Waiau	0·52	6	0·16	2·95
36	Gore Bay	0·57	4	0·22	2·71
37	Christchurch	0·49	6	0·40	2·21
38	Timaru	1·50	8	0·68	2·30
39	Lambrook Station, Fairlie	0·50	3	0·24	2·38
40	Benmore Station, Clearburn	1·26	8	0·66	2·77
41	Oamaru	0·66	6	0·29	2·11
42	Queenstown	0·76	5	0·36	2·72
43	Clyde	0·48	5	0·16	1·72
44	Dunedin	1·58	9	0·50	3·36
45	Wendon	1·17	5	0·73	3·22
46	Gore	1·12	6	0·56	3·09
47	Invercargill	1·72	6	1·13	4·01
48	Puysegur Point	6·02	12	0·84	7·22
49	Half-moon Bay, Stewart Is.	2·17	9	0·95	4·68

INSPECTION OF URBAN MILK-SUPPLY DAIRIES.

THIS matter was dealt with by the Director of the Live-stock Division in his annual report for 1926–27 as follows:—

The work connected with the inspection and registration of dairy premises supplying milk for direct human consumption entails constant and careful supervision on the part of the Inspectors, in order that the desired standard may be achieved and maintained. The work throughout the year has been carried out successfully, and on the whole the dairy premises are being maintained in a satisfactory condition. Some difficulty (financial and otherwise) naturally exists in a number of cases in getting all done that is required to bring the premises up to the required standard, and in these cases we have had to be satisfied with such improvements as could be effected. The amendment to the Dairy Industry Act which was passed and came into force during the year will enable the difficulty which has previously existed in regard to farms held on short tenancy to be overcome, in that the landlord is required to bear a share of the cost of improvements in proportion to the unexpired term of the lease.

In addition to the inspection of dairy premises, where special attention is given to cleanliness, methods of handling, and cooling of the milk, &c., a careful clinical examination of the cows is carried out, and any showing evidence of disease are destroyed; also suspicious cases are subjected to the tuberculin test, and if a reaction is shown they, too, are destroyed. Numbers of composite samples of milk are also collected and subjected to biological examination at the Veterinary Laboratory at Wallaceville and elsewhere, with an exceedingly small number of positive results.

Greater use has been made during the year of the New Zealand patent sediment-tester, further testers having been supplied to officers for use in addition to those previously supplied for the large centres. These testers are of value in affording direct ocular evidence of the condition of the milk in regard to dirt content, and it is proposed to further extend the supply of them to other districts.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LARVÆ OF SHEEP NASAL BOT-FLY.

A. W. M., South Norsewood :—

On splitting open the head of a four-year-old ewe, after killing, I found seven maggots, about ½ in. long, well up the nose and almost into the head. They were similar to the ordinary maggot, only larger and flat on the under-side, with more pronounced rings on the body, and two small black spots on the end of the tail, white and brown in colour. I should be glad to have any information about them, with cause and cure, if any.

The Live-stock Division :—

The maggots were the larvæ of the nasal bot-fly (*Oestrus ovis*). The mature fly deposits its larvæ in the region of the nostrils of sheep during the summer months. The larvæ find their way into the nasal cavities and air-sinuses of the head, and attach themselves to the mucous membrane, where they set up some irritation, depending on the number present. As a result of the irritation there is a chronic nasal discharge and sneezing, but seldom if ever are these parasites the cause of any mortality. The larvæ remain in position during the autumn and winter, and are ejected in the spring, when they develop into the mature fly. Treatment depends on the surgical removal of the larvæ, and where a number of sheep are affected this is therefore out of the question. The application of some dressing to the nostrils to ward off the flies is recommended as a preventive. Stockholm tar is suitable for this purpose, but, as with the flies causing bots in horses, no reliable dressing has so far been found which will permanently prevent their attack.

GRASS MIXTURE FOR SCRUB BURN.

J. D., Okoia :—

Please let me know what would be a good grass-seed mixture for sowing on rather steep country after burning scrub (Wanganui district).

The Fields Division :—

For sunny faces the following is recommended : Italian rye-grass, 3 lb. ; perennial rye-grass, 7 lb. ; crested dogstail, 4 lb. ; Danthonia pilosa, 3 lb. ; paspalum, 1 lb. ; colonial white clover, 1 lb. ; Lotus major, ¼ lb. ; subterranean clover, ¼ lb. : total, 19½ lb. per acre. For dark faces cut out the danthonia and add 1 lb. of brown-top.

AUTUMN-BEARING STRAWBERRIES.

"STRAWBERRY," Whakatane :—

Will you please inform me if there is a genuine autumn-bearing strawberry-plant in existence? I do not mean the varieties that will occasionally bear a second crop of fruit in the fall when probably the spring and summer crops have been rather poor, but a real genuine 100-per-cent. fall-bearing variety that would bear its fruit in March and April. If such a plant is in existence, would the fruit have any value commercially at a period when there are such a lot of other fruits waiting to be eaten ?

The Horticulture Division :—

In the long catalogue lists of strawberries there are a number which are stated to be autumn-bearing. In many cases they have their origin with well-known firms of repute, and they are doubtless true to description in the locality of origin. There are also sundry "ever-bearing" and "perpetual" varieties. But, interesting as these types are, they have not generally the cropping-capacity of the summer-bearing plants, and it is doubtful if the crop has an equal commercial value.

CONTROL OF SPURREY OR YARR.

"YARR," Mount Somers :—

I have always been able to grow very good turnips on my homestead paddocks here, but I can see trouble ahead, as yarr is appearing in almost every paddock. I would be obliged for any information as to the best method of dealing with this weed. It disappears entirely as soon as grass is sown down, and reappears with renewed vigour when the paddock is again broken up. All paddocks have been limed.

The Fields Division :—

Spurrey or yarr is an annual free-seeding weed which causes trouble in cultivated paddocks and young grass. Its presence may be taken as a general indication of the need for lime, and the application of about 10 cwt. to 15 cwt. of burnt lime per acre may materially modify the conditions under which spurrey flourishes. Sheep will eat spurrey with relish, and this affords a means of control by sufficiently heavy stocking to prevent seeding. A case, however, came to our notice recently in Canterbury of a farmer who lost about fifty sheep out of two hundred, mostly full-mouthed ewes with lambs; the lambs were not affected. The cause undoubtedly was due to feeding on a ploughed paddock which was growing spurrey and nothing else. Under these conditions spurrey may cause bloat, but it seems quite safe when mixed with grass. Elimination of spurrey is a difficult matter, but the general method adopted in Southland is to work the ground down as fine as possible in spring and make the conditions as favourable as possible to assist the germination of the seed. Thereafter repeated harrowings as soon as the seedlings show up will very largely assist eradication. This early spring fallow should be followed by sowing of green feed, such as oats and vetches, and subsequent heavy stocking.

ESTIMATED YIELDS OF WHEAT, OATS, AND BARLEY.

THE following estimated average yields per acre of wheat, oats, and barley for the season 1927–28 have been compiled by the Census and Statistics Office from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 8th February :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.	Barley. Bushels per Acre.
North Island	30·61	38·52	34·34
Nelson	19·00	21·95	23·00
Marlborough	30·20	35·76	34·89
Canterbury	34·52	43·76	39·03
Otago	34·82	41·74	32·97
Southland	34·83	44·26	32·00
Average (estimated) for the Dominion, season 1927–28	34·37	43·12	35·77
Average (actual) for the Dominion, season 1926–27	36·13	42·58	41·60

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 9,200,000 bushels, as against an actual yield of 7,952,442 bushels for the season 1926–27.

The percentage of oats threshed for the five seasons ending with 1926–27 was 27·05 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 3,650,000 bushels, as against an actual yield of 4,997,535 bushels for the season 1926–27.

Estimated average yields of barley were furnished this year for the first time. The percentage of this crop threshed for the five seasons ending with 1926–27 was 98·16 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 750,000 bushels, as against an actual yield of 1,243,333 bushels for the season 1926–27.

Correction.—A misprint occurred in the first paragraph of last month's article on the Northern Wairoa Experimental Farm (page 37) in the stated area of river-flats along the Northern Wairoa River. The figures should have been 120,000 acres, not 20,000 acres as printed.

The New Zealand

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MORTALITY AMONG YOUNG FAT LAMBS.

INVESTIGATIONS IN SEASON 1927.

D. A. GILL, M.R.C.V.S., D.V.S.M., Assistant Officer in Charge, Wallaceville Veterinary Laboratory.

Trials of Preventive Measures.

IN addition to continuing the research commenced in 1926 in Central Otago—of which an account was given in the *Journal* for April, 1927, under the title of "'Pulpy Kidney' Disease of Lambs"—some experiments were carried out during the past season in that district regarding the efficacy of the various preventive measures adopted for the purpose of combating the loss from this trouble. In spite of every effort to have these trials conducted under adequately controlled conditions, when it came to the point the controls were not as thorough as they might have been, owing to unavoidable circumstances connected with the season, &c. However, the results obtained are considered more reliable than any hitherto published in this connection, and it is felt that it will be useful to farmers who suffer losses of lambs to give an outline of the various experiments.

(1) OVERSTOCKING FROM LAMBING ONWARDS.

This was tried on a farm where heavy losses had been experienced for several years past. A paddock of 120 acres, where numerous deaths occurred last season, was partly ploughed and fenced off, so that 40 acres of the area was left in grass (very old pasture, mainly couch with a little rye-grass, suckling-clover, cocksfoot, and fescue), and eighty ewes were placed on the 40 acres about a fortnight before lambing. Deaths commenced here on 9th October. About the 20th the stock in the paddock was increased to 100 ewes and 116 lambs, although the older ewes were going back in condition. This paddock showed the highest death-rate on the farm—approximately 10 per cent., compared with an average death-rate in the other paddocks of about 4½ per cent.

Another somewhat similar experience may be mentioned. A farmer who lost heavily in the preceding year was visited early this season when deaths were just commencing. As an experiment he put two

mobs of ewes and lambs into one paddock. A further visit later in the season found this paddock grazed very close indeed, with the ewes and lambs in anything but prime condition, and yet there had been a considerably heavier loss in this overstocked paddock than in the others.

Apart from its not checking the death-rate, this practice is bad, because it certainly throws the ewes back in condition even if the lambs are not markedly affected. If persisted in, it means a considerable loss on the wool, besides greatly prejudicing the chance of getting the usual percentage of lambs away in the first draft to the freezing-works.

(2) EFFECT OF MARKING.*

Contrary to experience in many parts of New Zealand, particularly the North Island, marking appeared to have little, if any, beneficial effect as far as the mortality in Central Otago was concerned. In several instances deaths were few up to marking, and then during the succeeding few days were greatly increased. Several such instances were carefully investigated, and, save in a few cases, the deaths following the marking could not be attributed to blood-poisoning or other effects of the operation. In other cases, where marking was undertaken when a high rate of mortality was occurring, there was a check in the losses, but only for three or four days, and it seems very probable that this was due rather to the exercise, yarding, &c., entailed by marking than to the operation itself.

(3) EFFECT OF EXERCISE.

Only one controlled experiment was made, but several farmers tried it in a more or less haphazard fashion. The controlled trial gave the following results: Exercised mobs (totalling from 800 to 1,000), average death-rate 2½ per cent.; unexercised controlled mob of ninety lambs, loss eight, or approximately 9 per cent.

In another case the whole flock was exercised except the two-tooths, and here the death-rate was—Exercised mobs, average loss approximately 3 per cent.; unexercised two-tooths, average loss approximately 6 per cent.

A third farmer drafted out his twins and placed them on rich feed—low-lying rye-grass and clover paddock, thence to rye and lucerne, and finally to rye and cow-grass. He did not exercise these lambs. His singles were on terraces showing good feed—rye-grass, clover, and some cocksfoot—but not as good as that given to the twins—and in addition they were exercised daily. The difference in the death-rate of the two mobs is certainly striking in view of the popular opinion than twins are more or less immune from this trouble. It was as follows: Among singles, exercised, approximately 4 per cent.; among twins, unexercised, approximately 10 per cent.

The manner in which exercise was carried out in these cases was neither consistent nor particularly thorough, but is the best most farmers can do at such a busy time of the year. It consists of driving sheep about in the paddock with the dogs for a varying time each day. Some days a good half-hour might be devoted to a particular mob, whereas the next day only sufficient time might be available to rush

* This term as commonly used also includes castration and/or tailing.

them a few hundred yards or so. In spite of this, however, the cases quoted may be taken as fair examples, and they certainly show a saving in the losses.

(4) EFFECT OF YARDING.

Two different methods of yarding were tried. One proved of little if any benefit, whereas the other seems to offer the best means of prevention available.

Yarding Nightly.

From the time the lambs were a week to ten days old the mob was yarded up into a corner of the paddock (fenced off with standards and wire netting, with a big wing thrown out for driving purposes) every afternoon about 5 o'clock, and let out again about 8 or 9 o'clock the following morning. Details of the two cases in which this method was carried out are as follows:—

(*a*) Loss among yarded mob, 7·4 per cent.; losses among other lambs (excluding twins and two-tooths), approximately 3 per cent. This was the only controlled experiment of its type, and obviously in this single instance the large amount of extra work was worse than useless.

(*b*) In the second case there was not a proper control. Out of about forty-five early lambs, eight were lost from this disease, and judging by this a heavy death-rate among the main lot of lambs was anticipated. Advice was given to draft off the twins and to yard the single lambs each night as described. This was done, and as the twins were on good feed and no preventive measures were adopted they were, in a sense, controls. The losses were among singles, yarded nightly, 1·8 per cent.; among twins, not yarded, 1·9 per cent. In previous years this farmer had had about the same loss among his twins as this season, but a much heavier mortality among his singles, so that he may have benefited more in reality than is shown by the figures.

This method entails a very great deal of extra work, especially when several paddocks have to be dealt with, and, on the face of it, appears of very little use as a preventive.

Yarding for Twenty-four Hours every Seven Days.

The method of yarding was the same as that described for nightly yarding. Once a week the mob was yarded up in the morning and left in till the same time the following day. Where this method was adopted it gave very good results.

One farmer, who gave it a tentative trial last season on his own initiative, consented to test it thoroughly this season with an adequate control. His results, which speak for themselves, were as follows: A mob of 434 lambs was divided into two equal lots; one lot was yarded for twenty-four hours every seventh day; the other was not yarded. The loss in the yarded lot was ½ per cent; the loss in the unyarded lot was 3 per cent. Out of 160 twin lambs (80 pairs) eight died. He then yarded the lambs for twenty-four hours; one was found dead in the yard, and none died afterwards. Out of some 1,900 lambs his total loss was under thirty, and of this total fifteen died out of 377 that were not being yarded. Thus the average death-rate over the whole flock was less than 3 per cent. The death-rate among the yarded lambs approximated 1 per cent., and that among

the unyarded lambs was approximately 4 per cent. Reckoning a lamb's value at the moderate figure of £1, a saving of 3 per cent. of lambs in this mob of 1,900 was equivalent to £57. It is a note-worthy fact that the death among the yarded lambs occurred either in the yards or just before yarding. It would appear from this that possibly an interval of seven days is too long, and that about five days would be better.

Another farmer had nine lambs die in a certain paddock. He was then persuaded to yard the mob for twenty-four hours; no more deaths occurred here for eight days, when one was found sick and died later; the lambs were then yarded again, and no more died. In another paddock where a heavy death-rate occurred last season three lambs died; the mob was then placed on a ploughed paddock for twenty-four hours, after which the deaths stopped.

One more case is worth quoting. A farmer who had lost sixteen lambs out of 270-odd was of opinion that nothing would check the death-rate; but as he happened to have a ploughed paddock conveniently placed he agreed to put the whole mob there for twenty-four hours. Only two more died after this was done.

SUMMARY.

The results of this season's experiments in prevention of the disease may be summarized as follows :—

(1) Overstocking paddocks from lambing onwards is useless, and apt to be actually harmful.

(2) So far as Central Otago, at any rate, is concerned, the check in the death-rate caused by marking is negligible ; therefore this operation may be regarded as quite inadequate as a preventive measure.

(3) Exercise is certainly beneficial.

(4) Yarding nightly is cumbersome, and appears also to be of very doubtful benefit, besides giving the lambs a check.

(5) Yarding for twenty-four hours once a week has given very good results, with the additional advantage that it is the easiest method of all those tried. It is practicable on almost every farm where the losses occur, and a great point in its favour is that it gives neither ewes nor lambs any noticeable check. It is for the farmer himself to judge whether an interval of seven days or a shorter one of, say, five days does most good in his own particular case.

There seems to be a feeling amongst farmers who suffer from this mortality that preventive measures mean taking a great deal of trouble, and that it is very doubtful if benefit is derived. The foregoing out-line shows definitely that a considerable measure of relief is obtainable. The principal difficulty is that on most farms the ewes are not drafted into mobs as they lamb. It is but rarely that the size of the paddocks precludes this. In the great majority of cases it is a practice which might easily be undertaken, and the comparatively few farmers who do it state that with a little foresight and organization it is quite simple and takes very little time, besides making subsequent handling of the flock much easier. Very little thought will show that the preventive measures here advocated can only be properly applied where this system of drafting has been carried out.

Other Investigations and Opinions.

Apart from the foregoing experiments, investigations of a technical nature were carried on concerning the exact nature of the disease, and several fresh points were acquired. As a result the work of investigation is still being carried on at Wallaceville, though it must necessarily be slow. No useful purpose would be served by publishing the lines of research being followed, and this will not be done unless something tangible and conclusive is obtained.

Arrangements are already on foot for a series of fresh experiments in different districts next season—concerned with the possibility of preventing the disease by the use of sundry mineral licks.

It may be well, in view of the fact that such opinions have been advanced by men of some authority and hence adopted by many farmers, to repeat definitely that the disease causing the mortality is not lockjaw (tetanus); neither is it pneumonia. The theory recently advanced in Southland that the common weed sorrel is the cause is dealt with in another article.

NOTE.—The writer wishes to acknowledge his indebtedness to the authorities of the Medical School, Dunedin, for the many facilities granted him in connection with this investigation: also to Mr. David Weir, Inspector of Stock, Ranfurly, for his ever-willing assistance.

THE SORREL-POISONING THEORY OF LAMB MORTALITY.

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As is generally known, a theory was recently advanced in Southland to the effect that the commonly occurring mortality among fat lambs is caused by sorrel poisoning. In view of the statement made, and quoted in the press, that proof of this theory had been obtained, it is deemed advisable to publish the attitude of the Department of Agriculture towards it, and some account of relevant experiments made at Wallaceville.

The evidence on farms where the mortality occurs is quite against the theory; but since odd plants of sorrel are to be found in almost any pasture, and as there is in sorrel a salt of oxalic acid which affects the kidneys, it was thought well to go into the matter experimentally. Sorrel itself is not poisonous, but the oxalate contained in it if taken in sufficiently large amounts damages the lining of the stomach and bowel, and causes inflammation of the kidneys (the organs which excrete oxalates from the system). Hence it was decided to experiment with rabbits and lambs by the following methods: (1) Injecting doses of oxalate solutions into the veins; (2) giving doses of oxalates by the mouth; (3) feeding sorrel.

EXPERIMENTS ON RABBITS.

So far as the rabbits were concerned, death could easily be induced by injecting about forty grains of sodium oxalate in solution into the stomach through a tube. This was fatal in under three minutes

in one case, but neither with the naked eye nor with the microscope could any abnormality be discovered in the kidneys. Another rabbit was killed by giving it a series of injections of oxalate solution into the veins. In this case there were changes in the kidneys that were readily detectable with a microscope, and crystals of oxalate could also be seen in the kidney-tubules; but the type of change noted was different from that seen in lambs whose kidneys are "pulpy"; moreover, in the so-called "pulpy kidney" of lambs one does not find oxalate crystals. A third rabbit, which had been fed on sorrel only, for a week, without showing any signs of illness, was killed and examined. No abnormality was found; the kidneys were normal and showed no crystals.

EXPERIMENTS ON LAMBS.

In these tests six lambs were used, with the following results:—

Lamb No. 4A: This lamb, about seven days old, was given a series of injections of sodium oxalate into the veins. When about 10 grains had been given, at the end of the second day, the lamb died suddenly. Examination showed the kidneys to be enlarged and pale. Microscopically there were changes like those noted in the rabbit similarly treated, and here again oxalate crystals could be readily seen in the kidney-tubules.

Lamb No. 1: This animal, about six weeks old, was fed with doses of oxalates and oxalic acid, and allowed to run with its dam. In the course of ten days it had received 56 grammes of these materials and was markedly ill. It showed none of the symptoms seen in cases of pulpy kidney, however, its illness evidently being due to inflammation of the stomach and intestines. It was then given a single large dose of oxalic acid, and died quietly about an hour later. On examination the kidneys were found seriously affected. Small hæmorrhages had occurred in them, giving a mottled appearance; they were also enlarged, but there was no pulpiness, although the examination was purposely left till four hours after death to give this every chance of occurring. Microscopically it was seen that the kidney-tubules were badly damaged and contained very numerous crystals of oxalate. The hæmorrhages had taken place exclusively *into* these tubules, which is another small point of difference between oxalate poisoning and pulpy kidney.

Lamb No. 5: This was two to three weeks old, and was treated similarly to lamb No. 1. In five days it received 34 grammes of potassium oxalate and 9 grammes of oxalic acid. It was then killed by a large dose of the latter, and examined some four hours later. The kidneys were certainly damaged, but to a far less extent than in No. 1. The changes that had occurred were of a similar nature.

Lambs Nos. 2 and 3: These were about five weeks old, and were fed on a diet entirely limited to sorrel, except for about ten minutes night and morning, when they were allowed to suck their dams. Feeding was commenced on 17th November, and for the first three days sorrel in the flowering stage was given, but from the 20th onwards young leafy sorrel from a field under crop was gathered for them. They were hand-fed three times a day, and ate on the average about 12 oz. to 16 oz. each per diem. This was continued for over four

weeks (until 18th December), and during that whole period neither lamb showed any sign of illness or distress, save that each had a transitory attack of diarrhœa lasting two days (No. 2 on 5th December and No. 3 on 29th November). The lambs were both killed a week after sorrel feeding had been discontinued, and a careful examination was made. Microscopically there was evidence that damage to the kidney-tubules had occurred of a similar nature though to a much slighter degree than was seen in Nos. 1 and 5. Moreover, a few oxalate crystals could be detected in No. 3.

Lamb No. 6 : This was fed sorrel that had been mashed down in boiling water, and afterwards made to drink the water. A double handful of young sorrel-leaves was given in this way twice daily from 21st November to 18th December, without any ill effects being noticeable during that period or afterwards. The lamb was two to three weeks old when the experiment commenced.

COMMENTS.

Probably a perusal of these records will of itself be sufficient to show that oxalate poisoning is not the cause of the lamb mortality in the field, but a few additional comments may be made.

(1) Lambs Nos. 2 and 3 received far more sorrel than they could possibly have picked up for themselves when grazing an ordinary paddock. Further, although the oxalate present in the sorrel diet was sufficient to cause damage to the kidneys, far from causing sudden death it was not attended by illness of any sort.

(2) In none of the lambs experimented on was there any "fluid round the heart" or staining of the heart's inner lining, both of which conditions are constantly found in cases of pulpy-kidney disease as met with naturally.

(3) The changes produced in the kidneys by the oxalate treatments and the disease are somewhat alike, but by no means identical.

(4) The behaviour of a lamb after receiving large doses of oxalate (*e.g.*, lamb No. 1) is quite different from that of one suffering from pulpy-kidney disease.

(5) Samples of urine from cases of pulpy kidney in Central Otago were forwarded to the Department's Chief Chemist, who was unable to find any oxalates in them, whereas in samples from lambs 1 and 5 he found comparatively large amounts present.

(6) We did not find that lambs, even when hungry, showed any liking for sorrel, and while odd pieces might be eaten promiscuously with the other herbage, these experiments have shown that such small quantities are entirely harmless.

Nature of Pumice.—Pumice is a solidified volcanic froth. It contains all mineral food required by plants, but most of this is in an unavailable state, as it has been fused to a semi-vitreous condition. By the aid of organic matter and such farming operations as produce compaction of the soil and the incorporation of organic matter, pumice may be slowly decomposed. Green manuring is the best of all methods for improving pumice soils.—*B. C. A.*

PLANT-BREEDING AT CANTERBURY AGRICULTURAL COLLEGE.

WORK ON CEREALS, GRASSES, AND RED CLOVER.

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I. HISTORICAL OUTLINE.

By the year 1860 wheat-growing was an established industry in Canterbury, and the area devoted to this crop expanded continuously until 1880, when the average annual area amounted to 300,000 acres. During the earlier part of this period very numerous varieties of wheat were introduced, but by 1870 the commonly used varieties had become narrowed down to Tuscan, Hunter's, and Pearl, and this has governed the millers' and merchants' classification of New Zealand wheats from that time to the present day. Individual farmers, of course, still made occasional importations, but none of these (except Solid-straw Tuscan) was able to establish itself, largely owing to the fact that the old varieties had become wind-resistant by natural selection, while new introductions were badly shaken by the nor'westers.

During all this period there was no attempt at improvement of seed. New strains of the old varieties could not be introduced from England because they had gone out of cultivation there, so that even the names were lost, and there was no idea of systematic improvement from within. An occasional farmer rogued a few acres for seed, and a fairly clean crop was eagerly bought up by neighbours, but on the whole the different varieties were extremely mixed and impure. In 1909 an average crop contained 20 per cent. of impurities, and in many cases the wheats in a field were so mixed that it was impossible to guess which variety the farmer had intended to sow.

In 1910 Mr. R. E. Alexander, present Director of this College, suggested that an attempt be made to improve the wheats of Canterbury by the method of pure line selection, which had proved so successful with barley in Ireland, and the work was entrusted to the present writer. It was carried on in a small way out of the slender resources of the College, but in 1915 the first success had been achieved and the pure line known as College Hunter's had been distributed. In 1920 the Government, through the Department of Agriculture, provided for the continuance and extension of the work by making an annual grant of £500. Selection of oats was then undertaken in addition to further work on wheat. In 1921 the limit of improvement by selection among our New Zealand wheats appeared to have been reached, and crossing among pure strains was commenced.

In 1923 an extensive series of crosses was made between New Zealand wheats and the most promising of those from other parts of the world, and at the same time a very modest start was made in the selection of grasses. This work looked so promising that in 1925 the Department of Agriculture increased its annual grant to £1,000, and an assistant, Mr. J. W. Calder, was appointed to help in the work.

Selections of cocksfoot and rye-grass were made, not from the vicinity of the College alone, but from all the chief sown-grass areas

throughout the South Island, from Nelson to Invercargill. In 1927 a start was made with selections of red clover, and in the same year Parliament made a statutory grant towards the experimental work at the College, the share of the plant-breeding department coming to about £1,600 a year.

II. SELECTION WORK IN CEREALS.

(a) Methods.

A factor that has influenced the methods used is the kind and area of ground on the College farm. This yields an average of 45 bushels of wheat per acre. It is almost all absolutely flat, extraordinarily even in chemical and mechanical composition, and perfectly drained. It is divided into fields of about 25 acres in extent, and between 400 and 500 acres are under the plough each year. Any one of a dozen fields is available for plant-breeding plots, and there is always available a field that has borne a crop of rape or Italian rye-grass in the preceding season. Thus there is ample space available, the same ground has not to be used more than once in ten years, unevenness of soil is reduced to a minimum, and self-sown cereals do not occur among the plots. Owing to the size of the farm and the presence of working students at the College, both horse and hand labour are available whenever they are wanted, so that the facilities for breeding-work are probably as good as at any place in the world.

The unrestricted area of suitable ground has had a considerable effect on the choice of methods of trial. Single-ear selections are made from commercial crops, and each year and of each variety about one hundred head - to - row plots are sown in a permanent "bird - cage" enclosure. Elaborate trials have been made throughout the years to find which arrangement of plots would give the smallest probable error, whether chess-boards, or rows singly or in groups, and with replications up to ten in number. The result has been to abandon the expectation of any yield results from the bird-cage, and to rely on various forms of trial in the field.

About 25 per cent. of the rows are rejected on appearance or handling. Rows are eliminated if they show weakness of straw or too great length of straw, but especially if they show looseness of grain in the chaff, this character leading to shaking of the grain in the heavy hot winds that are common during the ripening season. Disease has little significance here. Rows are cut by sickle, and the bundles hung in a large shed until threshing. The thresher used consists of an old peg-drum machine from which the concave has been extracted, and on to the pegs of whose drum wooden beaters have been tied. Each sheaf is put in a cotton clover or timothy seed bag, and its heads held in the bag, against the beaters. When it is threshed the straw is thrown away, and grain and chaff emptied into a wire-gauze riddle, whence the chaff is blown away by an electric fan. The method is not as quick as some others, but it is cheap and efficient, and the maintenance of purity of the grain is absolute. Another 20 per cent. of the strains are rejected on grain sample.

In the second year the seed is sown in the open field, areas being carefully chosen for freedom from feerings or finishes in the last or any

traceable preceding ploughing. The strains are sown in three-row plots, each row about 15 ft. (or a rod) in length; the three-row plots of each strain are replicated three, four, or five times, as the seed permits. Every fifth three-row plot is a check. A few strains are rejected on sight or handling; the middle row of each of the survivors is harvested separately, and its two outside rows together. At first only the middle rows are threshed, in bags as before; then the seed is weighed and examined, and the worst yielders and those of worst quality are eliminated.

Certain strains remain, usually about thirty out of the hundred heads originally selected. Of these thirty, the sheaves made up of their two outside rows are now threshed, and all the seed of the same strain is bulked, dressed, and pickled ready for sowing.

The strains remain only one year in the bird-cage and one year in the rod-row plots. After that all trials are by field methods. Beaven's* half-drill-strip method is employed for testing strains against the parent variety, because these nearly always sow at the same rate. A fifteen-coulter drill is used; the middle coulter is blocked, the seed-box divided into two by a partition, and one-half receives the seed of the strain and the other half that of the parent variety. The drill is driven wheel on wheel mark, and the result is that one has pairs of plots separated by 14-in. spaces (our drill coulters are 7 in. apart), the number of pairs being limited only by the amount of seed available, or by the number of times that one chooses to drive up and down the field. The plots are drilled obliquely (usually at 45°) to the last ploughing, which means, in rectangular fields, obliquely to all preceding ploughings as well.

The plots are about 49 in. wide, and they are cut by a binder having a 54-in. knife. This allows perfectly clean cutting, and each row of sheaves as it lies on the ground represents a plot. Threshing is done in the field by a specially adapted locally made threshing-machine. This will thresh up to 50 bushels of wheat per hour, and the six men that are used for threshing can, when they become skilled, clean the machine out to the last grain in seven minutes. All the plots of one strain are threshed in succession, and weighings (but not cleanings out) take place after threshing the last sheaf of each plot. The yields are compared by Student's method.

The amount of seed available from the three-row rod-long plots replicated four or five times is about 4 lb., and this sows four to five strips 2 chains to 2½ chains long. That this method can be used with so small a quantity of seed is due, first, to the large area at our disposal, and, second, to the structure of colonial drills, which will sow to the last grain, and which can be completely cleaned out in a few minutes. The small number of replications made with the seed available does not, of course, allow of the best strains being selected, but it allows an elimination of a few of the worst.

Next year the same method is adopted, but an unlimited number of replications is possible. It has been found that 3 chains is a suitable length of plot, and that twenty replications give a result that makes a difference of 2 per cent. in the yield — that is, 1 bushel per acre — significant. This number of plots is therefore sown, and the resulting three or four best strains are selected.

* Beaven, E.S.: "Trials of New Cereals," *Jour. Ministry Agric.* XXIX, 4, 1922.

These few strains are grown by the half-drill-strip method for three or four more years; one is finally selected as the best available from the original hundred selections, and if it has for four or five years given a significant increase over commercial seed it is considered good enough to distribute to farmers.

The seed produced from the half-drill strips is unavoidably contaminated by seed from adjacent plots, and therefore this seed, while good enough for yield trials, is not good enough to sell as a pure strain. The pure seed is obtained by the following device: Just before the first half-drill-strip harvest—that is, before the strain has ever been touched by binding or threshing machinery—a few hundred heads of each strain are gathered and stored, it may be for one or two years. When it becomes obvious which strains are likely to be in the running for the final selection, the hand-selected sheaves of these strains are threshed and sown in a solid block well isolated from other strains. Each of these blocks is harvested and threshed with special care, and grown in a solid block again next year. Thus, when the final selection has been made and tested for a sufficient number of years, there is somewhere else on the farm a field of 20 or 25 acres of wheat of the same strain in a high state of purity and ready for immediate distribution.

SUMMARY OF METHODS.

First year: One hundred head-to-row plots in bird-cage. Threshed in bags.

Second year: Three-row plots hand-sown in field; three to five replicates; rows rod-long. Comparison by middle rows. Threshed in bags.

Third year: Field methods; half-drill strips, three or four replicates of blocks six coulters wide by 2 or 3 chains long. Threshed by machine. (Before harvest, hand selection of heads to provide pure seed.)

Fourth year: Twenty replicates of half-drill-strip plots about 3 chains long. After threshing, strains reduced to three or four.

Fifth year: Twenty replicates of the three or four strains, which are thus reduced to two or one. (Hand-selected heads of the three or four strains threshed and sown.)

Sixth year: Twenty replicates of two or one strains, allowing final selection. (Pure seed of two or one sown for multiplication).

Seventh year: Twenty replicates of final selection for confirmation. (Pure seed of that selection sown in a field, giving about 1,000 bushels for distribution.)

(b) Results to Date.

(1) WHEAT.

With wheat in the condition described earlier (page 156), plant-breeding at the College had every chance of easy success. Following is a brief account of the several varieties selected:—

1915: College Hunter's.—A pure line of the variety locally known as Hunter's was distributed after what we should now consider very imperfect trials. For three years it had yielded an average of 9 bushels per acre over bought seed. Owing to its purity as compared with the then available seed, it was favourably received by farmers, and the

accidental circumstance of its having a striking and beautiful colour was a fortunate advertisement of the beginning of our plant-breeding work. Its yield under all trials in various localities showed that it was probably 4 bushels per acre better than unselected Hunter's, which it rapidly replaced. In 1916 there were nineteen fields of Hunter's on the road between the College and Christchurch; two of these were the College strain. In 1917 there were twenty-two crops along the same road, and twenty of these were the pure strain. By 1918 the unselected seed had entirely disappeared. Twenty per cent. of the wheat grown in New Zealand is College Hunter's, the average yearly area being about 50,000 acres. This success, coming so early in the history of the trials, was an important factor in the public interest and support of the work of plant-breeding in New Zealand.

1918: College Solid-straw Tuscan.—This is a pure line of the variety locally called Solid-straw Tuscan. It yielded during five years of trials about 3 bushels per acre better than bought seed, but on other farms more adapted to this particular variety its superiority was more pronounced. Owing to its lack of any distinguishing feature, its reputation among farmers has never equalled that of College Hunter's, but it gradually permeated all Tuscan areas; and it is now certain that practically all the Solid-straw Tuscan in New Zealand is descended from this particular selection. "College Tuscan" probably accounts for 60 per cent. of the wheat grown in New Zealand—say, about 150,000 acres annually.

1918: College Purple-straw Tuscan.—A selection from a mixed crop of White-straw Tuscan, this wheat had very strong straw and a fair-quality grain. However, it filled no special niche in Canterbury farming, and could not stand the competition of Solid-straw Tuscan. It therefore was used for only two or three years, and then went out of cultivation

1918: College Pearl.—A selection from the variety locally known as Pearl. The strain was about 2 bushels per acre better than commercial seed, and the quality of the grain was very good and even. The wheat shook badly, however, and was soon replaced by the strain next recorded. It is now nearly extinct.

1920: College Velvet.—A selection from the variety locally known as Velvet. The strain yielded only 1 bushel per acre better than the commercial variety, and this was the best strain procured after ten years' trials. It was therefore decided to distribute it, because Velvet was a variety much desired by millers and the then available seed was very impure. Apparently the strain filled a want, and all the Velvet grown in Canterbury is now descended from it. Its wind-resistance is good for the variety, and its milling-quality is the best among all New Zealand wheats. College Velvet now accounts for 10 per cent. of the wheat grown in New Zealand—say, about 25,000 acres.

(2) OATS.

1923: College Algerians.—This is a selection from Algerian seed, originally brought from Australia, which had undergone natural selection in New Zealand for about fifteen years. The strain tillered well, recovered quickly after feeding off with sheep, gave a grain with a somewhat reduced proportion of husk, and during five years of trial at the

College beat commercial seed by 11 bushels per acre. It was an immediate success, increased yields of 20 bushels per acre being not infrequently recorded. By 1925 the ordinary market reports quoted College Algerians at 6d. a bushel above unselected seed, and two Christchurch firms between them sold 20,200 bushels of the seed, of which 3,000 bushels went to the North Island. Practically all the Algerian oats now grown in New Zealand are descended from this strain. It is grown in the South Island for threshing, for chaff, and for green feed for sheep in autumn and winter, and in the North Island for chaff and green feed. There is also a certain export trade in the seed to Tasmania and other Australian States.

1925: College Danish.—A selection from a yellow-skinned oat locally known as Danish. The strain yielded 3·5 bushels per acre better than commercial seed, but it never attained any popularity; the variety had largely gone out of cultivation, as it has no merits different from those of Garton's Abundance, the standard white oat of the country. College Danish is grown in only a few isolated localities, and will doubtless soon die out.

1925: College Duns.—A selection from the variety known locally as Dun oats—probably the English Winter Grey. The strain is of good quality, and outyielded commercial seed by 4·4 bushels per acre during four years of trial. The variety, however, is not very widely grown, and the strain is infested with or sports into a fatuoid impurity that has checked its free distribution. A purified line is now in process of multiplication.

(c) Detailed Results for Harvest of 1927.

Most of the work done during the season consisted of variety trials —which this article does not record—or of crossbred trials, which are recorded under Section III. A few strains were under trial as follows :—

(1) BELL'S SELECTION FROM COLLEGE HUNTER'S WHEAT *versus* COLLEGE HUNTER'S (see page 159).

John Bell was a student at the College in 1920. In a crop of College Hunter's he noticed one plant whose general characters were those of the main crop, but whose heads were noticeably more dense. The plant was saved, threshed, and grown as follows :—

1921–22 : A single row for observation.

1922–23 : A small multiplication plot.

1923–24 : In field—Five plots of about $\frac{1}{20}$ acre each; total weight of Bell, 238 lb.; total weight of Hunter's, 236 lb. In small plots—a ten-replicate chess-board—Bell better than Hunter's by 12 per cent. Odds in favour of significance, thousands to 1.

1924–25 : In field—Twelve replicates of half-drill-strip plots. Bell 7 per cent. better than Hunter's. Odds in favour of significance, 117 to 1.

1925–26 : In field—Fourteen replicates of half-drill-strip plots; College Hunter's, 50 bushels per acre; Bell, 54·6 bushels per acre; advantage in favour of Bell, 9·2 per cent.; odds in favour of significance, 2,000 to 1. In small plots—Eight replicates of three-row plots; increase over College Hunter's, 13·9 per cent.; odds in favour, thousands to 1. In small plots—Single rows, Hunter's and Bell alternating sixteen times; increase over Hunter's, 6·5 per cent.; odds in favour, 30 to 1.

1926–27: In field—Twenty-three replicates of half-drill strips. Increase over Hunter's, 1·1 bushels per acre; odds in favour of significance 103 to 1. The figures of this last trial are shown in Table 1.

It will be seen that on the whole series of years Bell has outyielded College Hunter's.

Table 1. Comparison of Bell's Strain and College Hunter's, 1927.

Plot No.	Kilos per Plot. Hunter's.	Bell.	Difference in Favour of Bell.
A 14	Lost in threshing	Lost in threshing	..
15	16·05	15·30	0·75
16	16·35	16·40	0·05
17	17·03	17·25	0·22
18	16·81	17·20	0·39
19	17·80	16·85	−0·95
20	15·84	16·25	0·41
21	15·40	15·40	0·00
22	14·90	15·00	0·10
23	15·40	15·00	−0·40
24	16·00	16·45	0·45
25	15·90	16·85	0·95
B 14	16·85	18·35	1·50
15	17·50	18·70	1·20
16	18·35	20·20	1·85
17	21·10	20·50	−0·60
18	17·35	19·20	1·85
19	18·25	19·82	1·57
20	16·90	16·55	−0·35
21	15·80	16·55	0·75
22	15·65	15·90	0·25
23	17·95	18·00	0·05
24	17·20	18·00	0·80
25	17·70	18·50	0·80
Means	16·82	17·31	0·44 = 1·1 bush. per acre.

NOTE.—Odds in favour of significance of result, 103 to 1.

(2) ALGERIAN OATS—PURE LINE B. 49 IN COMPETITION WITH COLLEGE ALGERIANS (see page 160).

The strain was originated from a head picked at random from a commercial crop in 1920.

1920–21: One of the best ten out of one hundred.

1921–22: Small plots—One of the best three of the above ten.

1922–23: No trial—multiplication only.

1923–24: Five replicate plots, each of about $\frac{1}{20}$ acre. Yield, 9 bushels per acre better than College Algerians.

1924–25: Twenty-four replicate half-drill strips. Yield, 7 bushels per acre over College Algerians.

1925–26: Similar trial. Advantage for B. 49 = 3·1 bushels per acre

1926–27: Eight similar replicates. Advantage in favour of B. 49, 5·6 bushels per acre; odds in favour of significance, 600 to 1.

Details of this last trial are given in Table 2. By mistake in drilling, guard plots were omitted, so that Plot pairs 1 and 13 (the outside ones)

could not be used in calculation. The small mill used to thresh B. 49 did not remove the awns at all completely, so that the strain was difficult to sow. In Plots 2, 9, and 10 there were obvious misses in the rows, so the pairs involved in those plots were also omitted from the calculations.

Table 2.—Yield of Algerian Strain B. 49 in Competition with College Algerians.

Plot No.	Kilos per Plot.		
	College Algerians.	B. 49.	Difference in Favour of B. 49.
Plot 3	40·1	45·5	5·4
4	35·3	46·8	11·5
5	43·7	45·0	1·3
6	42·3	50·2	7·9
7	42·5	50·4	7·9
8	51·1	49·3	-1·8
11	37·4	49·1	11·7
12	36·0	42·1	6·1
Means	41·1	46·6	6·2 = 5·6 bush. per acre.

NOTE.—Odds in favour of significance of result, 600 to 1.

III. CROSS-BREEDING OF CEREALS.

(a) Methods.

The methods adopted for selecting among the progeny of cross-breds are only slightly modified from those already described (page 157), and are briefly summarized as follows:—

First year: Cross made and seed sown.

Second year: All F. 1 sown.

Third, fourth, and fifth years: F. 2, &c., sown in plants to rows. Selection of promising strains by inspection. Testing for homozygosity for visible characters, and starting a new family with any individual variant now appearing.

Sixth and seventh years: Three-row plots, 1 rod long, replicated four or five times, the standard variety being inserted as check every fourth plot. From one hundred to two hundred families reach this stage. Elimination (largely arbitrary) of most strains, leaving twenty or thirty. (Single-ear selection started within the best families to secure greater degree of fixity, and to start supply of seed unmixed by subsequent half-drill-strip trials.)

Eighth to eleventh years: Half-drill-strip trials with constant elimination of families, and increasing exactness of trials of the survivors. (Building up pure supply of seed of the final selection separate from the half-drill strips as already explained.)*

(b) Results to Date.

Improvement by selection having been exploited until the rate of improvement was seriously slowed down, crossing was started in 1921 between pure strains. Only one cross has reached any advanced stage. This is the cross between College Hunter's and College Solid-straw

* Conf. Love, H. H.: A Program for Selecting and Testing Small Grains, *Jour. Amer. Soc. Agronomy*, XIX, 8, Aug., 1927.

Tuscan, and the object is to obtain the good grain quality and yield of Hunter's in combination with the solid straw and tightness of chaff of Tuscan. Many of the families show the combination to a promising degree.

In 1925-26 some of the families that had early proved homozygous were tried in 5-chain rows with Hunter's as alternate checks. The winter was abnormally wet, which may have given the crosses a special advantage. The yields for the first five families as compared with Hunter's were 140, 150, 140, 100, and 108 per cent. respectively. Many other families were tried in 1-rod rows.

In 1926-27, again, many families were tried in rod rows, and others of which most seed was available were sown in half-drill strips in competition with Hunter's. The results for the same five families as above were 114, 111, 103, 100, and 108 per cent. respectively.

In the present year families are being tested in half-drill strips, the number of replicates varying from five to thirty.

IV. SELECTION IN GRASSES.

The two most important sown grasses in the South Island of New Zealand are rye-grass and cocksfoot. The commercial seed consists of enormous numbers of strains all mixed up, and our first step in 1923 was to demonstrate this fact. We went into a field that had been sown in commercial cocksfoot, and grubbed up plants here and there, broke each down till it consisted of a single tiller, planted that in good soil till it grew into a clump, and broke the clump up into a row. When the rows were compared they showed that some plants produced three or four times as much feed as others. A single field produced an almost infinite number of types of leafage, habit of growth, date of flowering, resistance to drought, resistance to frost, earliness of spring growth, and any other economic characters that were considered. Two rows that happened to be growing side by side are shown in Fig. 1.

It was then argued that if there are different types of cocksfoot (or rye-grass) and a mixture of these types is sown in any special locality, then some will be more suited to the soil and climate of that locality than others are. Those that are least suited to the environment will die out soon, and those that are best suited will survive longest, so that an old pasture where the cocksfoots have almost all died out will contain only those types selected by nature as suitable for that special environment. For instance, on our dry shingle plains a reasonable stand of cocksfoot in its second or third year will in ten years be reduced to a few scattered plants, each many yards from its neighbour, and with the intervening spaces filled with weed grasses. Now, the assumption is that these scattered plants are those selected by nature as suitable to the dry shingle plain, and so we go to an almost exhausted field on such land and collect a hundred or two of the surviving plants. These are then broken down until one is sure that there is only one plant in the tuft. The tuft is grown in a garden until it becomes a fair-sized clump, and then all the clumps are taken back to the dry shingle plain, and there divided and planted out in rows for observation. Out of the hundred rows, all composed of plants assumed to be permanent on shingly country, one (theoretically) can be selected after a few years' trial as showing the best combination of economic characters ; and then

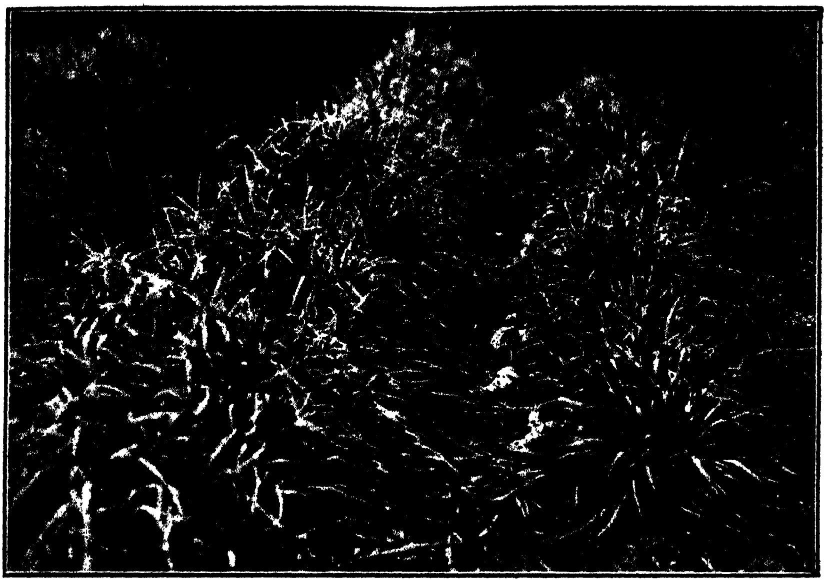


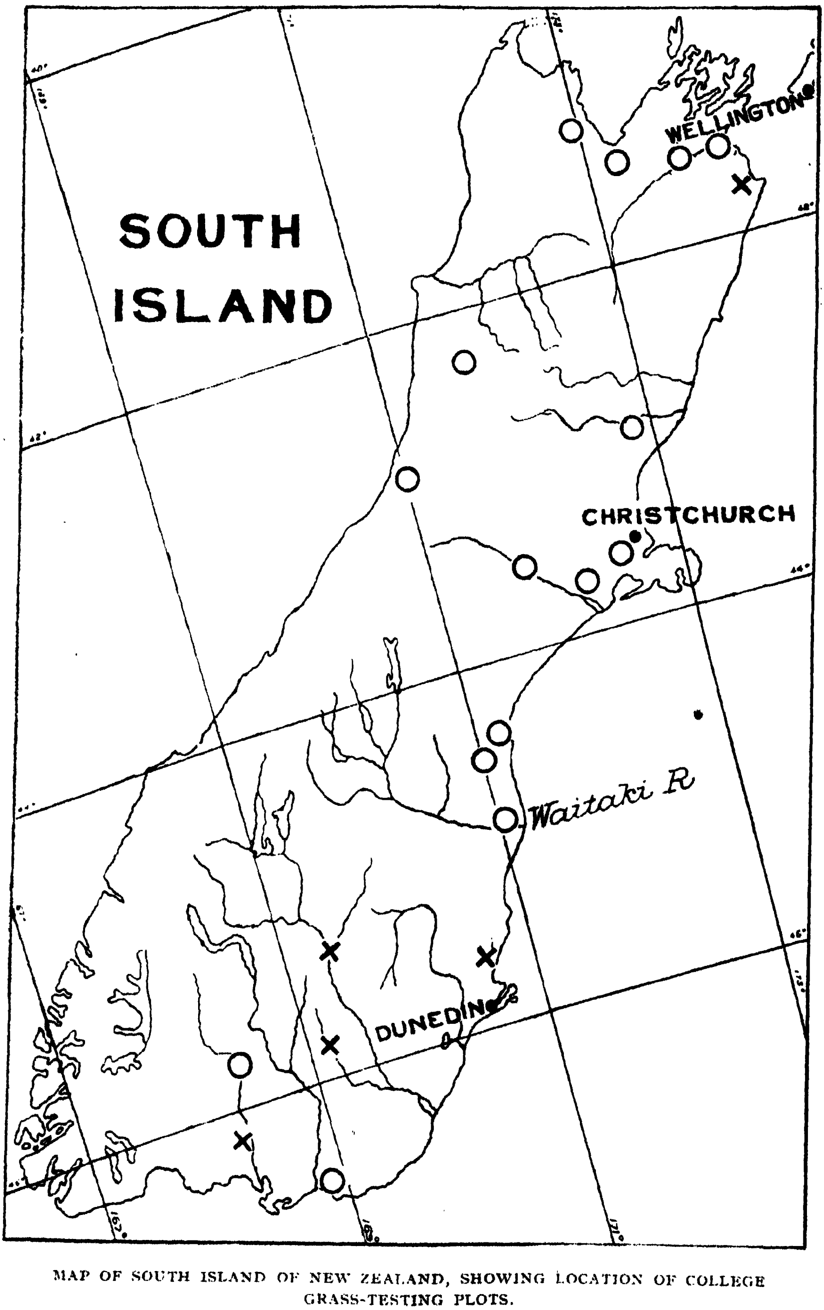
FIG. 1. TWO STRAINS OF COCKSFOOT SEPARATED OUT OF ORDINARY NEW ZEALAND SEED.

we shall be able to say, " Here is a cocksfoot permanent on your country, and highly productive, frost resistant, drought resistant, &c., there." As a matter of practice, not one but a few rows are likely to be thus finally selected.

In the belief that nature must make this selection among the enormously heterogeneous rye-grasses and cocksfoots she has to work on, we have gathered some of the strains she has approved from all the chief types of sown grassland in the South Island: from dry shingle plains near Nelson, Blenheim, Christchurch, Timaru, and Lumsden; from wheat-growing land at Blenheim and Lincoln, on the Timaru Downs, and near Tapanui; from cattle-grazing land with high rainfall in two places on the West Coast—Koiterangi and the Grey Valley from Omimi near Dunedin, and from Waimahaka in Southland; from the clays of the Moutere Hills near Nelson; from the lucerne land of Seddon; from the limestone faces of Waikari; from 2,500 ft. up on the front ranges of the mountains; from the almost desert area of Central Otago—in fact, from every region where we found a considerable and important area of any type of sown grassland. The localities of our plots are shown on the accompanying map.

Whether nature actually has produced such physiological ecotypes as our mode of work assumes we have never put to direct trial, for we have so far almost invariably grown each selection in its own environment. In the few cases where selections from two environments have been grown together distinct evidence of these physiological ecotypes has been noticed, though it appears that the formation of structural ecotypes has not gone as far as it has in England.* This, indeed, was

* Stapleton, R. G.: " Value of Selection, &c.," *Report Imperial Botanic Conference*, London, 1914.



MAP OF SOUTH ISLAND OF NEW ZEALAND, SHOWING LOCATION OF COLLEGE GRASS-TESTING PLOTS.

Circle (o) signifies established plots; cross (×) signifies plots in preparation.

to be expected from the comparatively short time that the English grasses have been growing here, and from the fact that it is not yet the custom to sow seed from one's own locality. When and where that custom prevails the formation of ecotypes in the same grasses will probably proceed with considerable rapidity.

Of course, all the work of selection would be useless unless there could be obtained from the selections seed that would reproduce the characters of its parent. That there is good hope of this being achieved we have gained some satisfactory evidence. In April, 1924, we chose several distinct types of rye-grass and cocksfoot, and planted

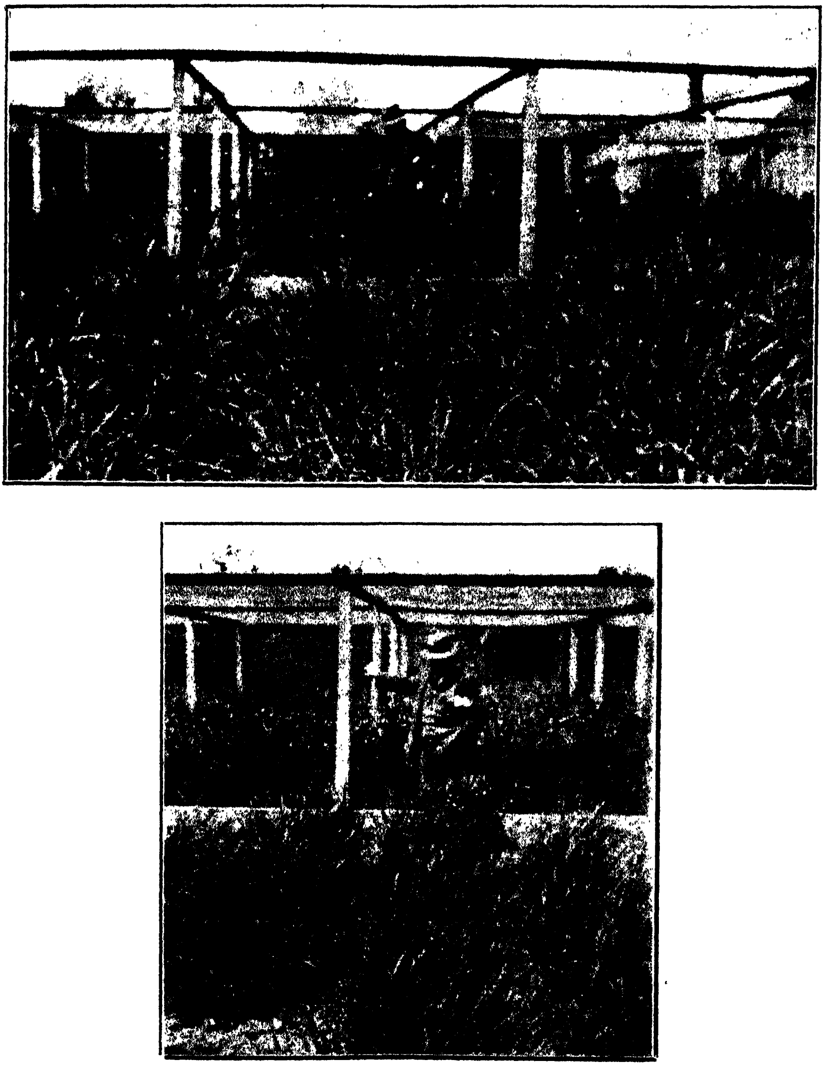


FIG. 2. SHOWING THAT SHELTER FERTILIZATION OF RYE-GRASSES PRODUCES SEEDLINGS OF HOMOGENEOUS CHARACTER.

(*a*, above) Seedlings of C 2—spready type; (*b*) seedlings of C 15—upright type.

small clones* of each type on a yard-square patch hoed out of the middle of a 30-acre field of oats and tares. Each clone was 5 chains from any other grass, and the lines of clones ran at right angles to our only hot and dry wind. The oats were Algerians, which when sown in March can be relied on to shoot by 1st November, so that at the time the grasses flowered the oats were 18 in. or 2 ft. taller than the grass flower-stalks. The tares had climbed high up the oats, so that each clone of grass was practically in a well of oats and tares, screened from drifting pollen to a considerable degree. Seed produced under these circumstances we have called "shelter-fertilized" seed.

A large quantity of seed was produced from each clone, and it was sown immediately after harvest in a greenhouse. Germination was generally fair, but in some cases poor. Growth was rapid, so that the seedlings were ready to plant out in the open with the first autumn rains, and by the following November were sufficiently far advanced for comparison. The seedlings from each clone were planted in a double row containing about sixty plants.

It is clear that if the parent clones were heterozygous for a considerable number of important characters, and if they were open pollinated, all the rows of seedlings would be alike. The measure by which the seedlings in any row are alike *inter se*, and different from those in other rows, is a measure of the efficiency of shelter pollination, and of the prospect of obtaining seed producing different types of the same grass. It was evident on inspection that each row consisted of seedlings very similar to each other in habit of growth and other economic characters, and that the separate rows were very different from each other. Two such rows are shown in Fig. 3.

To express the similarities and differences in figures, counts were made of certain easily observed characters in two adjacent rows of rye-grass, with the following results:—

Table 3.—Showing Differences between Seedlings of Two Clones Shelter-fertilized.

—	C 2.	C 15.	Difference.
Number of flowering stems per plant on 23rd November in first year	30·7 ± 1·66	43·4 ± 2·38	12·7 ± 2·86
Angle of flowering stems to the horizontal	44·8 ± 1·01°	79·0 ± 0·66°	34·2 ± 1·17
Length to top cauline leaf ..	20·5 ± 0·25	17·4 ± 0·27	3·1 ± 0·37 cm.
Width of top cauline leaf at 1 in. from base	7·20 ± 0·08	6·26 ± 0·07	0·94 ± 0·1 mm.

It will be seen that C 2 shelter-fertilized seed produced plants that were significantly fewer-flowered (or later flowered), more spreading, longer-leaved, and wider-leaved than the plants similarly produced from C 15.

In the case of the cocksfoot, at the same time as the shelter-fertilized seed was produced, self-fertilized and open-fertilized seed of some of

* A "clone" is a group of plants produced vegetatively (not by seed) from a single parent.

the same clones was also obtained. All three lots of seed were sown at the same time, and when the resultant seedlings were a year old both they and their parent plant were broken down into clones, each clonal plant consisting of a single tiller.

In a typical case there are forty-seven rows, each row a clone, and every clone given the same start in its present location. There are four rows of the parent plant; three rows, each of which is a clone of a plant sprung from a self-fertilized seed; twenty rows similarly produced from shelter-fertilized seed; and twenty rows of open-fertilized seed. If shelter fertilization is a useful practical procedure, then the twenty shelter rows ought to be nearly as similar to the parent rows as the self-fertilized rows are, and much more nearly similar to the selfed rows than the open-fertilized rows are. Unfortunately, the plants are not sufficiently far advanced to make measurements of particular characters, but inspection makes it clear that the above-demanded similarities

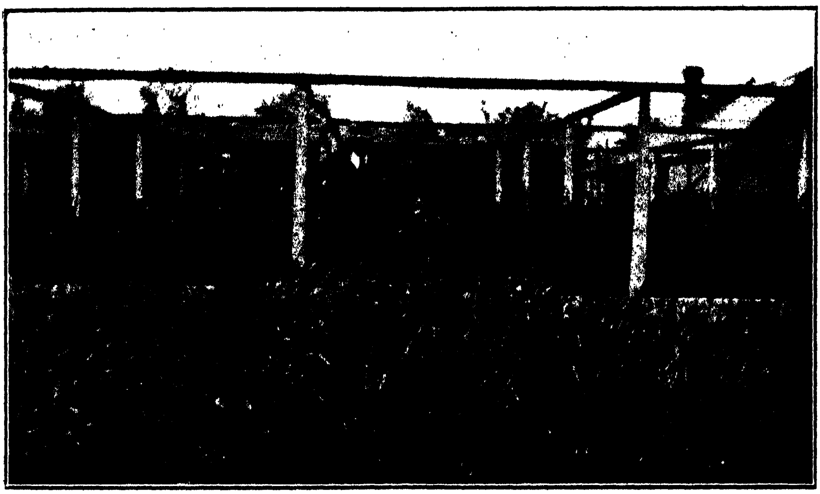


FIG. 3. SHOWING DIFFERENCE BETWEEN TWO ROWS OF RYE-GRASS SEEDLINGS.

and differences do indeed exist. Most of the shelter-fertilized rows have at present the same growth-form as the parent, and can be easily recognized as that parent's offspring, while among the open-fertilized rows there are all the differences that would be ordinarily expected among an equal number of chance selections. It is clear that this assumes that the parent plant was homozygous for many outstanding characters, and that this is so is proved by the similarity *inter se* of the three rows of selfed plants obtained.

In other cases the character of the selfed plants shows that the parent plant was heterozygous for the most obvious characters, but as far as we are yet able to judge the proportion of plants homozygous for outstanding characters is by no means small.

One further piece of evidence of the efficacy of shelter fertilization is available. In two cases we have rye-grass clones of parent and their shelter-fertilized offspring, and as these plants are further advanced

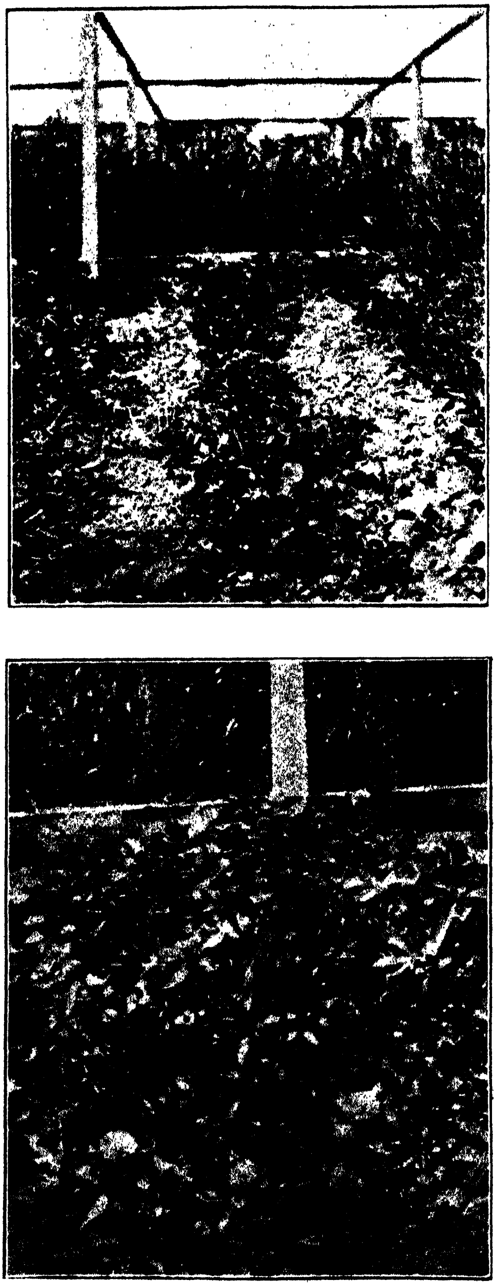


FIG. 4 (*a* AND *b*). TWO ROWS OF RED CLOVER GROWN UNDER THE SAME CONDITIONS.

Showing two of the many strains mixed in our ordinary New Zealand seed.

towards maturity than are the cocksfoot, some measurements were possible. The length and width of certain leaves were measured; the differences in these characters between the parent were not significant, and the differences between the offspring were non-significant also. In one feature, however, there was a marked difference between the parent plants, and this was completely reproduced in the offspring, as shown in the following table:—

Table 4.—Showing that Offspring by Shelter Fertilization resemble Parents.

—	Angle of the Flowering Stems to the Ground.	
	C 2.	C 5.
Parent	52·5 ± 1·2	75·0 ± 0·9
Offspring	44·8 ± 1·01	75·9 ± 0·8

It thus appears that shelter fertilization is a means of producing from seed fairly homogeneous crops of rye-grasses similar to their parent strains.

In the case described only 1 sq. yard was given to each clone to be shelter-fertilized, and enough seed was produced to sow thinly a plot of 48 sq. yards. If we found a rye-grass of sufficiently outstanding merit, and proved it homozygous for a sufficient number of characters of economic importance, we could raise a hundred times that quantity of seed by the same process—that is, enough to sow a field of about an acre. Inter-fertilization of most of the plants of such a field might be assumed, and so seed would be ready for immediate distribution.

V. SELECTION IN RED CLOVER.

This work was begun only in the early part of 1927. A field in the wheat-growing area was chosen which had been sown in grasses and clovers five years ago. A few scattered red-clover plants still survived, and these were dug up and examined for size of roots. Only those that appeared to be really old were chosen, and any that appeared to have arisen by reseeding were rejected. We thus hoped to secure the most permanent strains. Cuttings of the selected plants were made after the method of Sylven, of Svalof,* nipping off pieces of the stem about an inch below each node, and sticking the pieces into garden soil in a greenhouse. About 50 per cent. of the cuttings struck roots, and these were planted out in rows in early spring. Each original plant has thus produced a row of plants by vegetative propagation, and the rows can be compared. There are great differences in the habits of growth, date of flowering, and quantity of leafage among the various rows (see Fig. 4), as Williams† shows there are among the clovers of various nationalities. There seems to be a prospect of our being able in course of time to select a strain of red clover prolific and reasonably long-lived under our conditions of soil and climate.

* Sylven, Nils: *Sveriges Utsadesforenings Tidskrift*, Hefte 5, 1925.

† Williams, R. D: "Red Clover Investigations," Welsh Plant Breeding Station, 1927.

USE OF THE BURDIZZO CRUSHER.

BEARING ON THE FROZEN-MEAT INDUSTRY.

J. Lyons, M.R.C.V.S., Director, Live-stock Division.

An article warning against the improper use of an instrument known as the Burdizzo crusher or pincers, when used for the purpose of emasculating lambs, was published in the *Journal* for July, 1926. Since then the use of this instrument has increased among stockowners to a considerable extent. This no doubt is due to the fact that the method is seemingly more easily applied than any other, and also that the operation is bloodless. After noting carefully the effect of its application, however, a further word of caution is necessary with regard to its use.

When the instrument is being used care should be exercised to crush only one cord at a time, and to see that it is crushed; otherwise the operation is imperfectly performed. When used across the top of the scrotum or purse in order to catch both cords at once, there is a danger of cutting off the blood-supply to the parts underneath, in which case the whole purse may become gangrenous and slough off, thereby endangering the young animal's life.

When the instrument is used in the manner advised on calves and lambs that are well grown and with testicles fairly well developed, no exception can be taken to it. When used on very young lambs, however, it is doubtful if the operation will prove successful, and it is questionable if the designer ever intended the instrument to be used on such animals. In young lambs the testicles and cords are small and imperfectly developed; in many cases the cords are so slender that it is doubtful if the pincers close tight enough to get the proper grip to satisfactorily crush the cord. The result is an improper castration, and complete atrophy or wasting does not follow.

Even in those cases where the operation is performed satisfactorily it is doubtful if sufficient time is allowed to elapse between castration and the time of killing for the frozen-meat trade to allow the organ to waste sufficiently. Already there have been complaints from meat-works owing to the testicle not wasting after this method of castration. Further, in the case of two-toothed wethers castrated in this manner as lambs, the possible classification of them by the slaughtermen as "stags" is liable to be an endless source of trouble and dispute, while the lowered value of "stag" carcasses may ultimately be reflected in the price obtained by producers.

To sum up, while the Burdizzo crusher is capable of and will do satisfactory work when used on calves and lambs with well-developed testicles, I have no hesitation in stating that in the case of young lambs or calves the work performed is unsatisfactory, and breeders would be well advised to return to the old methods when castrating such animals.

New Zealand Wool Committee.—Mr. Herbert Hill has been appointed a member of this committee in place of Mr. L. B. Andreae, resigned.

PASTURE TOP-DRESSING EXPERIMENTS IN OTAGO, SEASON 1927-28.

R. B. TENNENT, N.D.D., Instructor in Agriculture, and A. A. HUME, A.R.C.Sc.I., Assistant Instructor in Agriculture, Dunedin.

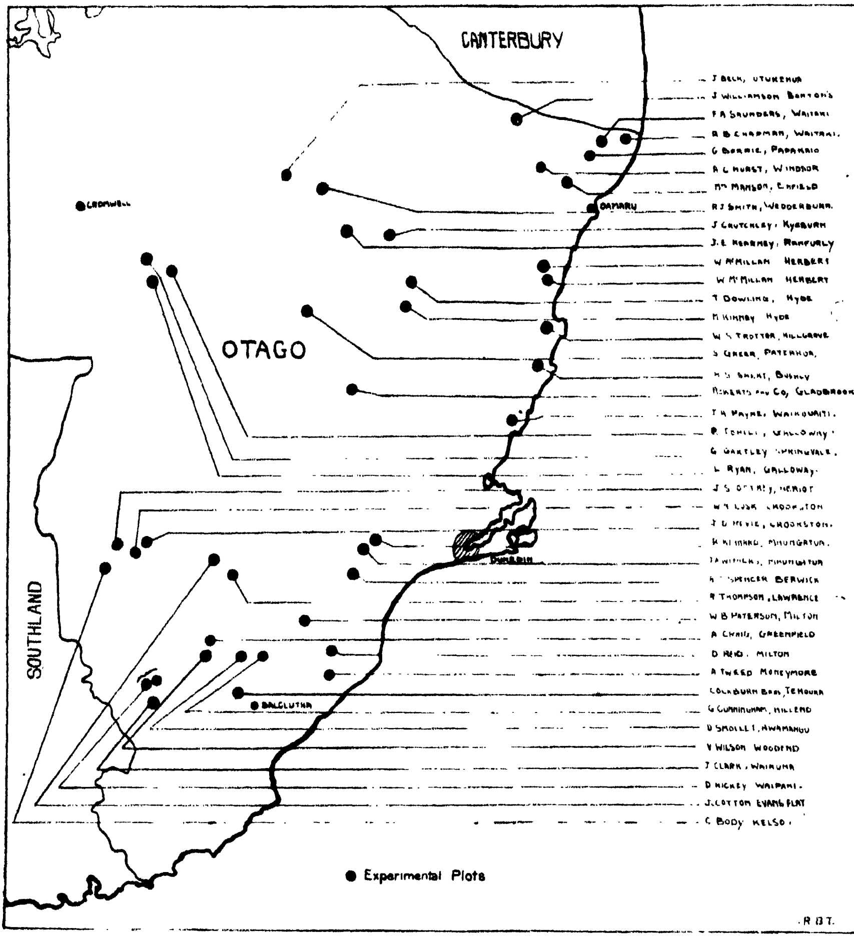
DURING the past few years considerable interest has been evinced in Otago in regard to the practice of top-dressing pastures. The results claimed by the application of fertilizers in different parts of the Dominion naturally caused many Otago farmers to suppose that similar results could be obtained in their province, and as a consequence the Fields Division in Dunedin has been inundated with inquiries asking for specific information as to the advisability of adopting the practice of top-dressing, and discarding the well-established practice of ploughing up old pasture and sowing down young grass.

Sufficient general information had already been collated by the instructional staff of the province to indicate that in some localities remunerative returns could be obtained from the application of certain fertilizers to pastures which had apparently outlived their usefulness, but on examination this information proved indefinite and in many cases open to doubt. It was therefore decided to inaugurate an extensive series of experiments on top-dressing, these to cover a wide area and to embrace within their scope a large number of soil-types and pastures of varying ages and condition. To this end the co-operation of the New Zealand Farmers' Union was enlisted, and as a result forty-two co-operative experimental plots devoted solely to top-dressing experiments were laid down and cut for hay during the past season. The wide distribution of these plots can be seen from the accompanying map (next page).

In arranging the scope of the experiment it was decided to adhere to a uniform plan throughout, using the drill strip method, thus allowing all results to be examined statistically. The method of laying out the plots was practically the same as that used by Mr. A. W. Hudson for the Fields Division experimental work in Canterbury, which has been fully described in the *Journal*. With the exception of three plots which were laid down during the season 1926–27 all plots received similar treatment. The plan of the experiments was comparatively simple, being to test the efficacy of phosphates both alone and in conjunction with lime, and further to acquire definite information as to the value of lime alone on pastures.

The phosphates under trial were superphosphate (44–46 per cent. grade) and basic slag (Trifolium brand, 17–20 per cent. grade). These manures were applied at a uniform rate of 3 cwt. per acre, and to ensure accuracy in this respect a drill belonging to the Department was utilized throughout. Carbonate of lime in a finely ground form was used at the rate of 1 ton per acre. The plots were dressed with the various treatments during the months of July, August, and September. Some of the dressings were therefore given at a comparatively late period, and this fact has to be taken into consideration in examining the first year's results.

At an appropriate period the plots were shut up for hay. On account of the large number of plots to be harvested it was naturally



MAP SHOWING LOCATION OF THE PASTURE TOP-DRESSING EXPERIMENTS IN OTAGO.

not feasible to get each plot dealt with at its peak point of production. This accounts for plots situated on high-class land in some cases showing comparatively low weighings when compared with those on poor soil-types. The yields given throughout in no way represent the relative fertility of the different plots.

The only gauge utilized in estimating the effect of the various fertilizers was the green-weight increase of the treated plots over the untreated or "control" plots. This obviously is not an ideal method of estimating the effect of top-dressing, but when taken in conjunction with the character of the pasture constituents on the various plots it affords a reasonable indication if any one treatment or combination of treatments is giving better results than untreated plots.

An endeavour has been made to present the results in a manner intelligible to farmers, for whom this investigation has been primarily

conducted. To this end all green weights harvested have been converted into estimated hay weights, and the yield per acre of hay is thus shown. An arbitrary value of £5 per ton has been given to all hay harvested, and from that has been deducted the value of the crop. Against this value the cost of the various fertilizers has been placed, and a profit or loss table over the control plot worked out.

In presenting these tables it is to be noted that the hay values only represent the amount of material harvested during the comparatively short period of time (about ten weeks on the average) during which the plots were closed to stock. The full cost of the fertilizers used has for convenience been debited against the hay thus produced. No residual effect has been taken into account, and it is only reasonable to expect that for the next few years the effect of certain fertilizers will be noticed on some portions of the plots. Again, it is to be pointed out that thirty-nine of the plots are in their first year of treatment, consequently no great effect from lime can as yet be expected. It is intended to carry on the experiment with these plots for a number of years in order to ascertain the length of time over which the effects of the different fertilizers used will be felt. For the next few years, therefore, the results of these experiments will be presented to farmers, and the profit or loss shown on each plot will be adjusted from year to year. For convenience this season's results are divided into groups—namely, North Otago, Central Otago, and South Otago.

North Otago.

(1) J. G. WILLIAMSON, BORTON'S.

This paddock, situated on rolling country adjacent to the Waitaki River, had been sown down with rape in 1923, no manure being used. The pasture before top-dressing had run largely to goose-grass, sweet vernal, and crested dogstail, small quantities of rye-grass, cocksfoot, and red and white clover showing through. The plot was top-dressed on 17th August, 1927, closed to stock on 1st October, and harvested 5th December. Results are shown in the following table:—

Table 1.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
30	Basic slag ..	6·8	N	0	10	1	2	11	3	0	15	0	0	1	3 (loss)
30	Basic slag and lime	7·9	N	0	12	0	3	0	0	1	8	0	0	5	6 (loss)
24	Superphosphate ..	29·1	S	2	4	0	11	0	0	1	1	0	8	1	6 (gain)
24	Super and lime ..	28·7	S	2	3	2	10	17	6	1	14	0	7	6	0 (gain)
44	Lime	6·4	S	0	9	3	2	8	9	0	13	0	0	1	9 (loss)
..	Control.. ..	4·9	..	0	7	2	1	17	6		..			..	

Summary: The effect of superphosphate on this plot was very striking; red clover responded to it most vigorously. No apparent results in the composition of the pasture could be noted at time of

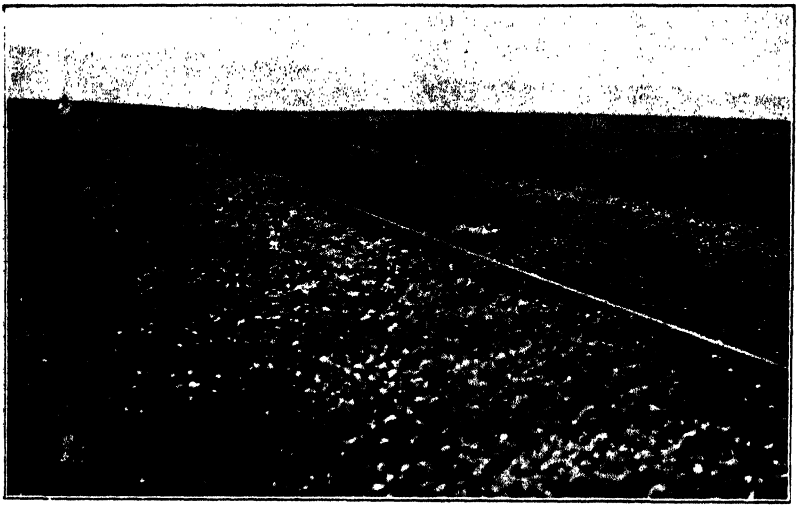


FIG. 1. PLOT ON J. G. WILLIAMSON'S FARM, BORTON'S.

Two strips top-dressed with superphosphate, showing heavy growth of clover. Control strip in between.

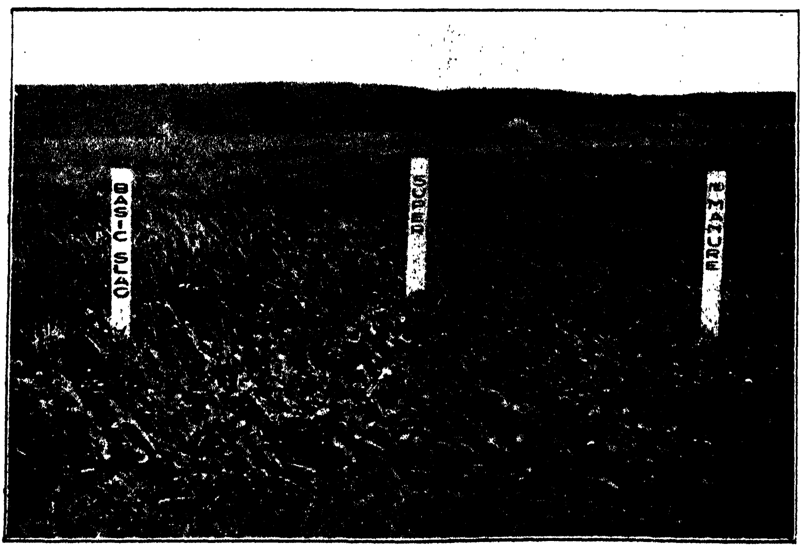


FIG. 2. END VIEW OF THREE TOP-DRESSED STRIPS ON SAME FARM.

Note clover growth in superphosphate strips (centre).

cutting from either lime or basic slag. This plot was kept closed to allow the aftermath to come away, and again the strips receiving superphosphate showed up most vividly. On the aftermath more clover growth could be noticed in the basic-slag strips than in the control strips

(2) R. G. BORRIE, PAPAKAIO.

The pasture utilized in this experiment is situated at the foothills of Papakaio, on a heavy piece of country locally described as a " tarry " soil, typical of a small area in the immediate vicinity. Sown down in 1904 with a mixture of rye-grass and red and white clover, it still held a fair sole of rye-grass and clover. Crested dogstail, sweet vernal, and other poorer types of vegetation, however, were gradually replacing the good grasses No manure has been used on this pasture since it was sown down over twenty-three years ago. The plot was top-dressed on 23rd August, 1927, closed to stock 1st October, and harvested 6th December. Results were as follows:—

Table 2.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
30	Basic slag and lime	18·4	S	0	16	0	4	0	0	1	8	0	0	10	6 (loss)
30	Basic slag ..	16·6	S	0	14	2	3	12	6	0	15	0	0	5	0 (loss)
30	Superphosphate ..	20·4	S	1	6	0	6	10	0	1	1	0	2	6	6 (gain)
30	Super and lime ..	34·7	S	1	10	1	7	11	3	1	14	0	2	14	9 (gain)
40	Lime	17·9	S	0	15	2	3	17	6	0	13	0	0	2	0 (gain)
..	Control.. ..	14·4	..	0	12	2	3	2	6		..			..	

Summary: As will be noted, superphosphate with lime gave the greatest increase over control. Lime alone showed a significant response, as also basic slag alone and basic slag with lime. It was observed that those strips top-dressed with super alone and super with lime showed a much heavier clover content than all other strips.

(3) A. C. HURST, WINDSOR.

This plot represented a considerable area of typical low hill country of the Windsor district, being situated on quite good land. The pasture had been sown down with rape in 1922, a meat-works manure being used at the rate of 1 cwt. per acre. The grasses used were cocksfoot, perennial rye-grass, crested dogstail, and cow-grass. The pasture showed distinct signs of deterioration, inferior grasses appearing in the sward. The cow-grass had given way to white clover. The plot was top-dressed on 18th August, 1927, closed 12th October, and harvested 20th December. Table 3 (next page) shows the results.

Summary: No great weight increases were observed on this plot, but there was an undoubted increase in white-clover content on those

Table 3.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
36	Basic slag ..	27·4	S	1	4	0	6	0	0	0	15	0	0	2	6 (loss)
30	Basic slag and lime	28·7	S	1	5	0	6	5	0	1	8	0	0	10	6 (loss)
36	Superphosphate ..	34·0	S	1	9	3	7	8	9	1	1	0	1	0	3 (gain)
30	Super and lime ..	31·9	S	1	7	3	6	18	9	1	14	0	0	2	9 (loss)
32	Lime	26·3	S	1	3	0	5	15	0	0	13	0	0	5	6 (loss)
..	Control.. ..	24·7	..	1	1	2	5	7	6		..			..	

strips receiving superphosphate. All differences in yields from the various fertilizers are significant, and, as will be observed, in this case super gave the highest weight increase. The effect of lime was practically negligible.

(4) MRS. MANSON, ENFIELD.

This plot is located on a typical "tarry," heavy soil at Enfield. The pasture had been laid down about 1917, the grasses used being chiefly cocksfoot, rye-grass, crested dogstail, and red clover. At the date of laying down the experimental plot the pasture had chiefly gone to cocksfoot, crested dogstail, and white clover, with a large proportion of inferior grasses and weeds showing through. The plot was top-dressed on 19th August, 1927, closed 1st October, and harvested 8th December. Results are tabulated below:—

Table 4.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
30	Basic slag ..	19·5	S	0	17	0	4	5	0	0	15	0	0	5	0 (loss)
30	Basic slag and lime	19·7	S	0	17	1	4	6	3	1	8	0	0	16	9 (loss)
30	Superphosphate ..	36·9	S	1	12	1	8	1	3	1	1	0	3	5	3 (gain)
30	Super and lime ..	35·0	S	1	10	2	7	12	6	1	14	0	2	3	6 (gain)
40	Lime	17·6	S	0	15	1	3	16	3	0	13	0	0	11	9 (loss)
..	Control.. ..	17·3	..	0	15	0	3	15	0		..			..	

Summary: On harvesting this plot the super strips could be clearly defined on account of the increase of white clover thereon. Super and super with lime gave the heaviest weighings, forming quite a good sole on the strips so treated. No other treatments showed visible response, despite the fact that when their weights were analysed slight significant increases were recorded.

(5) W. McMILLAN (WINDMILL PADDOCK), HERBERT.

This pasture had been sown down in 1925 with rye-grass, crested dogstail, and red and white clover. Although naturally decreasing in rye-grass content, it is still well covered with this grass. The pasture, therefore, when top-dressed was in good condition. The plot is situated on low country adjacent to the coast. Top-dressing took place on 24th August, 1927; the plot was closed 1st October, and harvested 9th January, 1928. Table 5 gives results.

Table 5.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
30	Basic slag ..	24·9	S	1	1	3	5	8	9	0	15	0	0	3	9 (loss)
30	Basic slag and lime	28·8	S	1	5	1	6	6	3	1	8	0	0	0	9 (gain)
30	Superphosphate ..	28·0	S	1	5	0	6	5	0	1	1	0	0	6	6 (gain)
30	Super and lime ..	29·4	S	1	5	3	6	8	9	1	14	0	0	2	9 (loss)
40	Lime	26·8	S	1	3	2	5	17	6	0	13	0	0	7	0 (gain)
..	Control.. ..	22·4	..	0	19	2	4	17	6		..			..	

Summary: A general increase of clover from all treatments was noted on this plot, a combination of superphosphate with lime giving the heaviest yield. Lime alone gave quite a significant increase over the unlimed plots, and in this respect it is to be noted that the pasture is comparatively young. The results from this plot should afford some interesting points next season.

(6) W. McMILLAN, HERBERT.

This pasture had been sown down in the autumn of 1921 with oats, the grasses used being rye, dogstail, and red and white clover; no manure was used. The pasture had deteriorated considerably, a fair proportion of Yorkshire fog and brown-top taking charge. The plot was top-dressed on 24th August, 1927, closed 1st October, and harvested 10th January, 1928. Results were as under:—

Table 6.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s	d.
30	Basic slag ..	14·1	S	0	11	0	2	15	0	0	15	0	0	17	6 (loss)
30	Basic slag and lime	15·5	S	0	12	0	3	0	0	1	8	0	1	5	6 (loss)
30	Superphosphate ..	16·0	S	0	12	2	3	2	6	1	1	0	0	16	0 (loss)
30	Super and lime ..	16·5	S	0	13	0	3	5	0	1	14	0	1	6	6 (loss)
40	Lime	15·7	S	0	12	1	3	1	3	0	13	0	0	9	3 (loss)
..	Control.. ..	14·5	..	0	11	2	2	17	6		..			..	

Summary: This plot was really not advanced enough for harvesting, being extremely slow in making recovery. The weights throughout were poor, and in no way indicate the possibilities of this pasture. A perusal of the results will show that although there is little difference in the yields recorded for the various treatments the differences are significant. This would indicate that under more favourable conditions of growth greater differences between treatments would be recorded. The plot will be closed to stock at a more opportune time next season. It should be noted, however, that the six strips top-dressed with superphosphate stood out quite plainly, on account of the greater proportion of white clover growing upon them.

(7) W. S. TROTTER, HILLGROVE.

Sown down about 1902, this pasture had run mainly to sweet vernal with a sprinkling of white clover throughout. The pasture was miserably poor, and little result was anticipated from the manurial treatment. Top-dressing took place on 15th August, 1927; the plot was closed 1st October, and harvested 9th December. The following table gives results:—

Table 7.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
30	Basic slag ..	21·4	S	0	18	3	4	13	9	0	15	0	0	5	0 (loss)
30	Basic slag and lime	25·0	S	1	1	3	5	8	9	1	8	0	0	3	0 (loss)
30	Superphosphate ..	34·1	S	1	9	3	7	8	9	1	1	0	2	4	0 (gain)
30	Super and lime ..	35·2	S	1	10	3	7	13	9	1	14	0	1	16	0 (gain)
44	Lime	21·8	S	0	19	1	4	16	3	0	13	0	0	0	6 (loss)
..	Control	19·3	..	0	16	3	4	3	9	..			..		

Summary: Excellent results were obtained from superphosphate, the recovery of white clover being most marked. It appeared incredible that a response of this degree could be obtained on such a run-out pasture, the superphosphate strips with their dense mats of clover showing out most clearly. Slag also responded, but to a much less visible degree than super. Although an increase in weight was obtained as a result of liming, no visible difference could be noted. This plot was kept closed to allow an aftermath to grow, and again the strips top-dressed with super showed out most markedly.

(8) H. S. SHEAT, BUSHEY.

The pasture upon which this plot was situated is reported to be over twenty-five years of age. For such an old pasture its condition prior to top-dressing was very satisfactory, there being a good sole of rye-grass and white clover. Naturally, a fair proportion of brown-top and crested dogstail showed throughout. The plot was top-dressed on

25th August, 1927, closed 8th October, and harvested 8th December. Results are presented below:—

Table 8.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	37·7	S	1 13 0	8 5 0	0 15 0	0 3 9 (gain)
30	Basic slag and lime	39·2	S	1 14 1	8 11 3	1 8 0	0 3 0 (loss)
30	Super	43·5	S	1 18 0	9 10 0	1 1 0	1 2 9 (gain)
30	Super and lime ..	46·5	S	2 0 2	10 2 6	1 14 0	1 2 3 (gain)
40	Lime	37·2	S	1 12 2	8 2 6	0 13 0	0 3 3 (gain)
..	Control.. ..	33·4	..	1 9 1	7 6 3	..	..

Summary: Superphosphate in conjunction with lime gave the highest return, a much closer sward of white clover being observed in this treatment. No apparent differences could be noticed in the cross-dressings of lime; an increase, however, was recorded in their weighings. As will be noted, all treatments gave a significant increase.

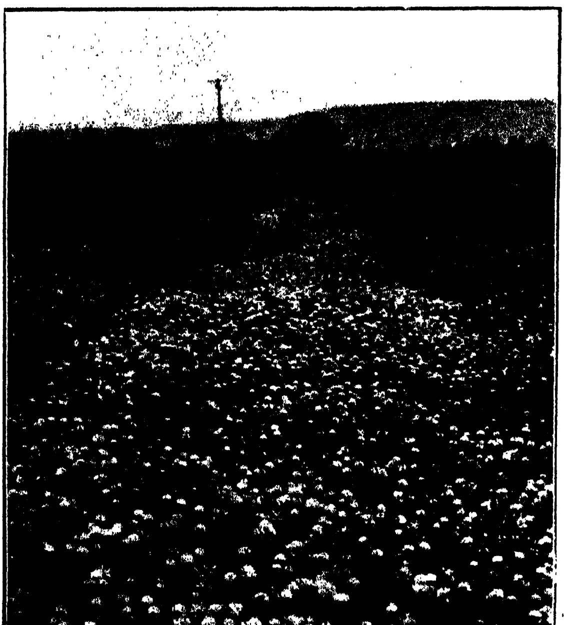


FIG. 3. PLOT ON W. S. TROTTER'S FARM, HILLGROVE.

Dense mat of white clover in superphosphate strip (centre). Control on left; basic slag on right.

(9) J. A. PAYNE, WAIKOUAITI.

The pasture selected for this trial was laid down in 1915. Since that date it has been used largely as a horse-paddock, much coarse, rank vegetation growing upon it. From a pasture viewpoint this paddock was in poor condition, on account of the prevalence of brown-top and rank fog and cocksfoot. White clover was interspersed throughout. Top-dressing took place on 25th August, 1927; the plot was closed 1st October, and harvested 19th December. Table 9 gives results.

Table 9.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	14·5	S	0 12 3	3 3 9	0 15 0	0 1 3 (loss)
30	Basic slag and lime	13·6	S	0 11 3	2 18 9	1 8 0	0 19 3 (loss)
30	Superphosphate ..	16·3	S	0 14 1	3 11 3	1 1 0	0 0 3 (gain)
30	Super and lime ..	16·8	S	0 14 3	3 13 9	1 14 0	0 10 3 (loss)
40	Lime	13·0	S	0 11 1	2 16 3	0 13 0	0 6 9 (loss)
..	Control.. ..	11·4	..	0 10 0	2 10 0	..	..

Summary: At the date of harvesting the plot showed a very uneven appearance on account of the great variability of the soil-fertility. This can be largely attributed to the horse-manure scattered throughout, and emphasizes the difficulty of obtaining uniform results on a pasture of this nature. As will be observed from the table, small differences were recorded. A distinct difference in clover content could be observed in those strips top-dressed with superphosphate. More definite results can be looked for from this experiment next season, as it is Mr. Payne's intention to keep horses off the plot. The removal of the coarse grass will also result in more even growth.

(10) J. B. CHAPMAN, WAITAKI.

This was an extremely interesting experiment on an old pasture dating from about 1892. The pasture, situated on the gravel terrace of the Waitaki River, had run to Danthonia pilosa, sweet vernal, goose-grass, and suckling-clover. Numerous other grasses and plants were prevalent throughout the pasture, all of an inferior nature. Definite information was sought in regard to the effect of top-dressing this type of grassland, and a plot was accordingly laid down on 22nd August, 1927, and closed on 20th October.

The plot was kept under close observation for a period of twelve weeks. Very little growth took place on any of the strips. The only difference which could be observed was a distinct increase in suckling-clover on those strips top-dressed with superphosphate. The growth on the whole plot was too light to harvest; consequently observations only could be made. No effect could be observed from basic slag or lime. On this year's results even the increase in suckling-clover could

not justify top-dressing. The plot will again be closed for observation next season. In the meantime, however, it appears that top-dressing an old run-out pasture on this type of soil will not pay. These remarks do not apply to young grass, Mr. Chapman having obtained encouraging results from his own experiments on new pastures.

(11) R. F. SANDERS, STEWART SETTLEMENT.

This pasture is a purely native one, mainly composed of Danthonia pilosa, into which had encroached such species as goose-grass, English hair-grass, and sweet vernal, while a small amount of suckling-clover could be noticed throughout. The pasture is situated on the old gravel terrace of the Waitaki River, and the experiment was conducted to afford information as to the effect of top-dressing this class of grassland. In many respects the plot resembled that of Mr. J. B. Chapman (No. 10), and the results obtained were practically similar. Top-dressed on 16th August, 1927, the plot was closed to stock on 1st October. Close observation was made at various times throughout the period. A fair general growth took place over the plot, but proved too light to harvest. A definite increase in suckling-clover content on those strips top-dressed with superphosphate could be noted. No other treatment appeared to have taken effect. The increase of suckling-clover in this year's results could not justify the expense of top-dressing. Bearing in mind the dryness of this class of country it will be interesting to observe next season's results.

STATISTICS OF TOP-DRESSING ON FARMS.

INFORMATION regarding areas top-dressed in New Zealand, together with the kinds and quantities of fertilizer applied, was collected in the 1926–27 season for the first time. The summarized figures show that 1,521,259 acres were top-dressed, the total quantity of fertilizer used amounting to 4,383,002 cwt., or 219,150 tons. With reference to the total area quoted, and obtained by adding together the areas top-dressed with the fertilizers stated, it should be borne in mind that this figure is not an accurate representation of the actual total area top-dressed. This is accounted for by the fact that in many cases where farmers top-dressed the same area with two or more of the fertilizers quoted, either separately or as a mixture, duplication of such areas under the appropriate fertilizer headings undoubtedly resulted. Consequently the actual total area top-dressed would be correspondingly less.

Nature of Top-dressing.	North Island.		South Island.		Dominion.	
	Area.	Quantity used.	Area.	Quantity used.	Area.	Quantity used.
	Acres.	Cwt.	Acres.	Cwt.	Acres.	Cwt.
Superphosphate	825,811	2,038,641	159,351	314,909	985,162	2,353,550
Basic slag	252,328	730,410	10,440	28,359	262,768	758,769
Other artificial fertilizers and manures	152,218	452,024	9,641	30,624	161,859	482,648
Stable and farm manure	3,683	..	792	..	4,475	..
Lime	52,898	266,832	54,097	521,203	106,995	788,035
Totals	1,286,938	3,487,907	234,321	895,095	1,521,259	4,383,002

—*Census and Statistics Office.*

THE FEEDING OF LIVE-STOCK.

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III. FOODSTUFFS IN COMMON USE.

THE present series of articles has so far dealt with the chief constituents in the plant foods which are utilized by stock. An endeavour has been made to explain in simple terms what the constituents are, and for what purposes they are used by the stock.

To summarize, it has been stated that the chief plant-constituents used are the proteins, the carbohydrates, the fats or oils, the ash or mineral portions, the vitamins, and, lastly, water. It is from these substances that the necessary elements for growth, fattening, milking, &c., are derived. They are consumed, digested, and passed through a process of elaboration, according to the type of stock, before being stored in the animal body or used for milk-production, &c.

It has been explained how the protein or the nitrogenous portion may be utilized in necessity to replace a deficiency in the carbohydrates, and how the converse cannot take place. But where farm crops constitute the chief source of food it may be concluded that the utilization of proteins for this purpose will never occur, it being more likely that stock will suffer a partial protein starvation on home-grown foods unless care be exercised.

The discussion then passed on to consider the uses made of the various food materials, and the influence of the food on the different processes. The effect of a liberal protein-supply on milk-production was stressed as a very important factor. It both increases and stimulates production.

These aspects of the subject having been dealt with, attention will now be directed to the various foodstuffs in common use. At the present day this constitutes rather a formidable list of materials. A few of the more important concentrates should be of interest to a small section of the community, but special attention will be given to home-grown foods.

PASTURE.

There is a continuous change all over the country, a gradual passing from one type to another from the point of view of both quality and type of grasses which go to make the pasture. As one passes from fertile valleys up to the high ranges this change in quality, although possibly not observed in its gradual course on adjacent farms, becomes very obvious at either extremity.

In the high ranges nothing but the poorer grasses can be maintained, so that before the season advances too far lambs for meat-production have usually to be removed and fattened off on more liberal and nutritious places. In many instances, in fact, young breeding-stock would greatly benefit in constitution if they could be wintered off. Inclement weather plays a very important part with the stock, but it also affects their grazings. The greatest difficulty for hill stock is to pass the spring of the year successfully. This is the season when their

food-supplies are down to a minimum, and, unfortunately, little can be done to avoid it owing to the difficult nature of the country, ordinary methods of grassland-improvement frequently being impracticable.

Another type of grassland which should be noted by all stockmen is that with a calcareous soil. This is always very healthy stock-country and invariably easily handled; it is very amenable to treatment and always improves greatly with good husbandry. It is also greatly benefited where a little cultivation is done for the stock.

The remaining types of permanent pasture, although varying very much as a whole, may be treated as one. The grasslands of New Zealand outside the aforementioned may nearly all be regarded as in this class, as comparatively little land is laid down to temporary pasture. Permanent pasture is frequently held to be the best type obtainable. That is rather a big assertion to make, but it will be agreed that if well cared for and in good heart it is very economical and productive. Unfortunately, it suffers very greatly and becomes of low productivity if not given a great deal of attention, which frequently requires much hard thought.

So far as New Zealand is concerned, nature takes the major part of the responsibility in maintaining the pastures. Growth is normally abundant and luxuriant for a great part of the year— so much so that one finds considerable indifference to its management among a fairly large number of farmers. Although conditions are so suitable to growth, it must be remembered that all types of grasses are encouraged, and if the farmer does not maintain a continuous effort inferior species will very soon gain the upper hand of the finer grasses, even to their complete exclusion. Grassland, being the staple diet of our stock, should receive all the attention which it requires. The quality of the stock and the quality of their feeding are two things which cannot be separated. The one is just as important as the other.

Perhaps the greatest drawback to permanent pasture is its liability to become seriously fouled. One frequently hears of land being "pig-sick" or "cattle-sick" (no specific disease in New Zealand is now referred to), but the truth of the matter is more plainly and truly described when the land is said to be fouled or contaminated.

As regards short-rotation or temporary pastures, the chief benefit lies in their being composed of a greater proportion of superior grasses and cleaner in every respect. They are thus more healthy for stock. This type of pasture is only possible where a limited amount of cropping is being carried on.

Pasture-management.

The management of pastures from the point of view of animal husbandry is not, on the whole, a very difficult or complicated procedure. The first essential to be grasped by the farmer concerns the methods of grazing adopted by the various kinds of stock. The horse, for example, is a very selective grazer. Wherever horses are grazed the paddock becomes very patchy, because he grazes only certain portions, leaving the remainder to grow coarse. Again, it must be remembered that although the horse may graze certain areas closely he only does that of necessity, as he grazes by means of his prehensile lips. The horse is the most difficult animal to pasture of all, and, where possible, should never be allowed to graze alone.

Sheep, again, graze very closely, and devour all the fine bottom grasses, and leave the others ; this is the great difficulty with them. Dairy cattle, on the other hand, are very uniform grazers, grazing quite freely and only avoiding the very coarse grasses.

It may be seen from the foregoing brief remarks that, by a judicious manipulation of stock, pastures may be kept under proper control. That, of course, does not mean that the great growth of summer-time can be properly controlled or eaten and kept down by stock alone. Pasture can only permit of an even number of stock being maintained. This results in overstocking during the winter season and understocking during the summer. This cannot be easily avoided, which is unfortunate, for although the grasses are not all eaten they lose very considerably in value as they reach maturity.

About this same period aftermath becomes available, and adds greatly to the grazing, especially for dairy cows. Where the aftermath is from newly sown grass it should be very lightly grazed. It benefits by a light grazing, but if that cannot be done it is better left without stock till the spring. Sheep especially may do considerable damage to young grass. In many cases it may be advisable for autumn purposes to have some specially sown crop available for stock-feeding. In very few cases, in fact, would this fail to be beneficial.

Spring and autumn are the trying times for the pastures, and if grassland is too heavily stocked immeasurable damage will be done to farm and stock alike. Care is necessary and judgment required to keep land stocked to its greatest capacity, and the only possible way that this can be safely done is by having adequate resources of other foodstuffs available.

For pasture to be consistently nutritious it should be liberally manured and as completely as requirements demand. This subject will not be discussed here, except for one point—namely, that lime is the most health-giving material which the farmer has for his stock. Lime should be used wherever circumstances allow.

In general, pasture land gives the best returns where grazed and rested alternately.

ROOT CROPS.

Roots provide the great bulk of the succulent roughage for winter use. Where they can be grown successfully they are a valuable type of food and greatly relished by farm stock. The main objection is their cost of production, and in some cases the difficulty in growing them. But roots fill a very special purpose. They have a very beneficial effect on the health and production of milking-cows, ewes, and other stock. The nutritive value of roots lies in their carbohydrate content, which is chiefly in the form of sugar, and that fact explains why they are easily assimilated. Protein and fat may be regarded as deficient in them.

The growing of roots serves a twofold purpose—it is a cleaning crop for the land as well as a source of food. The first purpose is often not fully taken advantage of.

To obtain the greatest returns from a root crop dairy stock ought to be rationed, and sheep should be folded on to a limited area and that cleaned up before the stock is allowed to move on. The method frequently adopted of allowing the stock to roam all over a root

paddock has really nothing in its favour. The method is fundamentally wrong; it is wasteful, or, rather, extravagant; it is not conducive to good health, and it generally makes a quagmire of the land. In too many instances it must be described as the limit of carelessness. But, even so, some benefit is obtained by the stock. Roots have a characteristic laxative effect, which is very beneficial, especially to dairy cows.

For pigs, roots form a very valuable supplementary food. Often the animals are allowed to feed the crop off; but better results, of course, are obtained when the roots are pulled and fed with other food. When pigs are being hand-fed about 5 lb. of roots per day is as much as will be consumed. As fattening advances the roots should be reduced in daily quantity and given in small amounts.

Turnips and Swedes.—The storage of roots greatly enhances their feeding-value, owing to a rise in the sugar content, especially in swedes. This root, therefore, should be reserved for winter and early spring use. Swedes especially should not be fed when freshly pulled. The value of turnips over swedes lies in the fact that they ripen earlier and are ready for use in autumn. This, having regard to their composition, makes them a useful supplement to pastures which are failing Frosted leaves of turnips may cause serious digestive troubles.

Mangolds.—Mangolds are very useful in the dairy herd for later use, or, rather, after the swedes are finished and spring growth has not yet commenced. They have a slightly higher feeding-value than swedes, this being due to an increase in the sugar content and other soluble carbohydrates. Newly lifted mangolds have a very severe laxative effect. They should always be pulled and allowed to lie a considerable time before feeding—not hours, but days, or even weeks. Mangolds should not be fed continuously to male sheep, as they may cause the deposition of urinary calculi (gravel in the water).

Carrots.—Carrots are considered particularly valuable as a horse-feed, but they are also fed to cows. The red or yellow varieties impart a beautiful rich colour to the milk, owing to the colouring-matter, carotin, which they contain. In some districts carrots are grown as a supplementary forage for sheep. Carrots have a slightly higher feeding-value than mangolds. For feeding, carrots should be regarded as having an equivalent value of 7 lb. to 1 lb. of oats. They contain the same amount of dry matter as potatoes, but only half the feeding-value. Raw carrots, however, are more valuable than raw potatoes. They are excellent feeding for sick animals. Horses in work should receive from 6 lb. to 8 lb. per day

Rape is used either for pasturage or as a soiling crop for sheep and swine, but it may be cut and fed green to cattle, having proved an excellent feed for all three classes of stock. Owing to its high water content and its narrow albuminoid ratio (1 : 4·3) it does not feed well alone, but ought to be fed along with low-protein feeds, such as maize, cereals, and wheat middlings, or with pasture or hay. It is a valuable crop, especially for autumn use, more particularly in the fattening of lambs and sheep.

Kales, Cabbage, &c.—These form a very useful feed for autumn use when pastures are failing, but are no better than some other more cheaply produced auxiliary crops.

Pumpkins.—This crop has not assumed very great importance as a feed, but when grown is fed to cattle, sheep, or swine. In composition it resembles quite closely the turnip. Some feeders are doubtful about the value of the seeds, but these should never be wasted.

Potatoes.—The potato is a carbonaceous food, containing as it does 21 per cent. of carbohydrates. It has the smallest water content of all "roots," and therefore its feeding-value is higher than any other root crop. Potatoes make a very satisfactory feed, but dairy cows should not receive more than 20 lb. per day. Potatoes are very liable to cause digestive troubles; the starch-grains are very large, and this makes them difficult of digestion when raw, except to herbivora—for example, dairy cattle. When potato feeding to any stock commences, the potatoes should be introduced gradually into the ration. Cooked potatoes are an excellent food for pigs, especially finishing pigs; they should never be fed raw, or digestive troubles are sure to follow. When comparing potatoes with meal in pig-feeding, 4 lb. of potatoes should be regarded as being equal to 1 lb. of barley-meal. With dairy cattle 6 lb. of raw potatoes is equal in feeding-value to 1 lb. of mixed meal. Old sprouted potatoes should have the sprouts removed before feeding, as poisoning may result from a substance called solanin. In Germany dried potatoes are held to be as valuable for the feeding of horses as oats.

Artichokes.—Jerusalem artichokes are the common winter feed for pigs; they are rarely fed to cattle or horses. Although so frequently made the sole feed for pigs, the reason these animals do not thrive so well on them alone is that they contain too little protein for a pig's requirements. Some other food must be added to provide this for successful rearing. The large stems and leaves of the artichoke, if cut off above ground, make excellent green feed for sheep, young cattle, and even dairy cows. If cut when 6 ft. high, the yield of tubers is not appreciably affected. The great feeding-value placed upon artichokes should be taken with reserve.

(To be continued.)

CHEAP SEED-MIXTURES: A WARNING.

PURCHASERS of seed for bush burns and hill country are advised against the buying of "cheap" mixtures as advertised throughout the Dominion, without first ascertaining whether they are really worth the attractive prices asked. Several analyses made on behalf of prospective buyers have shown that the mixtures in all cases are worth approximately only one-half of the price asked, and that a mixture of good-quality seeds in the same proportions could be bought for about 1d. per pound more than is asked for the inferior seed. Samples of advertised cheap seed are being obtained from various sources, and the results of analyses will be published in the *Journal.*

—*N. R. Foy, Seed Analyst, Biological Laboratory, Wellington.*

THE GRASS-SEED INDUSTRY IN SOUTHLAND.

N. R FOY, Seed Analyst, Biological Laboratory, Wellington, and R. McGILLIVRAY, Instructor in Agriculture, Invercargill.

THE New Zealand grass- and clover-seed industry is centred mainly in the South Island, wherein it is divided into several groups, the two largest being Canterbury and Southland, where this line of production takes an important place in farming practice. Southland is mainly a grass-seed producing centre, only a comparatively small quantity of clover-seed being saved. The rye-grasses (perennial and Italian), Chewings fescue, and crested dogstail are the species produced in greatest quantity, while brown-top, Lotus major, and wild white clover are saved in appreciable amounts.

The history of the grass-seed industry in Southland goes back to the early "nineties," when considerable quantities of rye-grass seed passed through the stores. At the present time what was then regarded as a side-line has developed into an organized industry, with extensive machining plants at Gore and Invercargill. Approximately 30 per cent. of the New Zealand acreage under seed crops belongs to Southland, and the province produces 30 to 35 per cent. (approximately 4,500 tons) of the total New Zealand output.

RYE-GRASSES.

In the 1926-27 season in Southland 42,082 acres were under rye-grass for seed, the production being 3,028 tons, or nearly 40 per cent. of the Dominion total. Perennial rye-grass is a most important species in Southland, and under the better pasture-management of to-day much of the richer land of the province is carrying first-class swards of it which are improving with the increase in fertility following on top-dressing.

In the past the local demand for seed has been extensive, but with the increasing permanency of pastures this local requirement has diminished, and more seed has been available for distribution to the North Island and for export. It is upon the export demand that the industry depends for its development, and growers may rest assured that this demand is dependent to a large extent on the quality of the product. The principal overseas buyers are Australia, Great Britain, and the United States of America.

CHEWINGS FESCUE.

The production of Chewings fescue is almost wholly confined to Southland, where in the 1926-27 season 9,108 acres produced more than 940 tons of seed. Chewings fescue was introduced into Southland in the late "seventies," and was grown by a Mr. Tarlton near Invercargill. The seed saved was taken by him and sown on a farm at Mossburn, which district, together with the Waimea Plains, has become the centre of the production area. The Mossburn property was later purchased by the late Mr. George Chewings, who was responsible for the initial commercializing of the seed.

The New Zealand requirement for this seed is now small, and practically the whole of the output is available for export. In 1926

nearly 700 tons was exported, over half being absorbed by the United States, where it is in great demand for lawns and golf-links turfing purposes. The value of this trade in 1926 was estimated at £61,500.

Some of the Chewings fescue is put down with rye-grass, but although this may be advantageous from a grazing point of view it is not to the best advantage for seed-cropping, as the rye-grass seriously affects the purity of the fescue. The more common practice is to sow the fescue alone at about 12 lb. to 14 lb. per acre. The pasture is grazed in the first season and seeded in the second, this being followed by a second grazing until August, when the areas are rejuvenated by skim-ploughing. In some localities up to seven and eight crops are taken off before skim-ploughing, but this is inadvisable, as the plants lose vitality, to the detriment of the seed crop. Under the best conditions the maiden crops should be limited to three.

Top-dressing is now carried out on many areas with beneficial results, both from a grazing and seed-production viewpoint. Experience has demonstrated that the greater the vitality shown by the plants the higher will be the vitality of the seed produced. Chewings fescue is a delicate seed and quickly affected by adverse conditions; therefore lines with a high vitality are more easily able to withstand unsuitable storage conditions, &c. It is thus very advisable that growers should produce a thoroughly matured seed from strong-growing plants. Maturity is intimately associated with vitality in all seeds, and the more mature the seed is allowed to become before it is removed from the parent plant the greater are its storage capabilities, weight, and general quality.

CRESTED DOGSTAIL.

In the 1926–27 season Southland produced approximately 520 tons, or 80 per cent., of the New Zealand output of dogstail. The principal areas of production are in the Gore district, but nearly all parts of the province grow dogstail in varying amounts. A small proportion of the seed is saved from permanent pasture, but the bulk is taken off areas specially sown at the rate of 14 lb. to 18 lb. per acre. As is the case with rye-grass and Chewings fescue, the crop is usually cut with the reaper-and-binder, but the stripper is used to some extent, especially on sheep-pastures.

The Dominion requirements for dogstail-seed are considerable, but there is also a considerable surplus for export, which is absorbed mainly by Britain. In 1926 over 100 tons, valued at £20,000, was exported. Like Chewings fescue, crested-dogstail seed suffers from a deterioration in germination during shipment overseas. This, it is held, is due to low vitality of the seed following incomplete maturity or production from weakened plants; and seed of a poor vitality is unable to withstand the extremely unsuitable storage conditions existing in most cargo-holds. The trouble has been remedied to some extent by the growers allowing the crop to stand as long as possible before harvesting, so that the seed may almost fully mature. The light-golden colour of the seed, so popular with Southern growers and merchants, is a sure indication of immaturity, and the aim of the grower should be the dark-bronzy colour of thoroughly ripe dogstail. Unlike rye-grass, which requires a hot, dry harvest, dogstail and Chewings

fescue both benefit from cooler moist conditions prior and subsequently to cutting, so that the seed may be prevented from rushing to an apparent ripeness before it is properly matured.

BROWN-TOP.

Southland has only recently taken up brown-top seed production, which until a few years ago was confined to the Waipu district of Auckland Province. There are many areas of pure brown-top in Southland where, until the specific identity of the grass was known, it was allowed to seed and go to waste. Previously known locally as couch and twitch, brown-top is now systematically seeded in quantity, a very fine quality seed being produced. All seed is fully dressed, and compares more than favourably—from a germination and purity viewpoint particularly—with the brown-top from any other district. Considerable quantities are absorbed within the Dominion, and in 1926 approximately 25 tons, valued at £7,000, was exported, mainly to the United States.

Brown-top is harvested in the same manner as other grasses. Some growers cut the crop far too early, in which case the seed is practically useless. The ripening crop is deceptive, appearing ripe when far from it. For harvesting, the plants should be nearly dry, and the seed not quite on the point of loosening in the glume.

WHITE CLOVER.

It is only of recent years that white clover has been seeded in any quantity in Southland. Last season 185 acres were devoted to this crop, 21,160 lb. of seed being produced. The Southland seed is taken mainly off permanent pasture, and is usually of the wild white type. With the more extensive use of lime and artificial fertilizers the clover content of pastures in the province is increasing, and there will be no doubt an increasing amount of seed saved. The success of the New Zealand white clover seed trade is dependent upon an export demand, which demand should increase materially with the introduction of a system of crop inspection and certification of genuine old pasture types.

LOTUS MAJOR.

A fair amount of Lotus major is produced in the province. The seed, mainly in the Mokoreta and Waiau districts, is usually of splendid quality and entirely free from other species of Lotus. Some growers appear to cut well on the green side, as is evidenced by the high percentage of brown shrivelled seeds in a few lines. The quantity placed on the market would be about 8 to 10 tons.

TIMOTHY.

A small quantity of timothy-seed of splendid quality is saved by one or two growers. It is regrettable that there is not more produced, so that our annual importation of approximately 100 tons might be reduced.

COCKSFOOT.

Cocksfoot is very widely distributed in Southland, but the acreage actually set aside for seeding is small, and the total amount of seed

saved runs from 30,000 lb. to 40,000 lb. annually. Unlike that of several other districts in New Zealand, the local cocksfoot-seed does not seem to be looked upon with much favour. Our annual importation of some 800 tons of cocksfoot could be reduced by at least 100 tons were much of the wasting cocksfoot saved throughout the Dominion. There are many obviously valuable close leafy strains in the Southland pastures which doubtless could be propagated with advantage, but until the value of the different strains is actually demonstrated and appreciated the locally grown seed is not likely to be in marked demand.

THE COMMERCIAL ASPECT.

From a commercial aspect Southland is one of the most important seed-production districts in New Zealand, and a large amount of capital has been expended in stores and machine-cleaning plants. Seed is purchased by merchants as farmers' dressed direct from the mill, or it is dressed at so-much per pound on behalf of the grower, who then offers it as M/D, or machine-dressed. In either case a sample is submitted for test, so that the buyer can fully assess and place a value on a line under offer.

The importance of purity and germination is becoming better recognized, and these factors are now relied upon to a greater extent than are the older quality-factors—weight and colour. These, of course, cannot be ignored, but they are secondary to the purity and germination factors. That the importance of these tests is recognized is shown by the fact that during 1927 over 30 per cent. (3,377) of the samples received at the official Seed-testing Station came from Southland.

FUMIGATION OF VINERIES WITH CALCIUM CYANIDE.

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CALCIUM CYANIDE is fast taking a leading position as a destructor of vermin and insect pests. As a means of controlling mealy bug in vineries it is more simple, less dangerous, and quite as efficacious as the old pot method of cyaniding. Before attempting to use this remedy the operator must realize that he is dealing with a very deadly gas, the inhalation of which will cause death. However, there should be no serious danger if reasonable precautions are taken.

So far as the vines are concerned, there is a risk of burning the foliage and grapes when the latter are in their green stage, and grape-growing authorities in England now advise the use of cyanide only after the grapes have been cut. Notwithstanding this sound advice, it sometimes happens that the mealy bugs—the pest we have to deal with here—are very much in evidence when the grapes are green, and threaten to ruin their market value. Under such circumstances a grower can afford to take some risk in order to obtain a clean and profitable crop.

DOSAGE.

The exact quantities which will at the same time exterminate the mealy bug without danger to the crop must be ascertained by the grower himself, by working up gradually to a dose which proves sufficiently strong to kill the insects and weak enough to avoid burning the tender foliage and green grapes. The most effective quantities will be found to differ considerably on account of the variation of gastightness of the houses, which should be rendered as tight as possible.

In the green stage ⅓ oz. per 1,000 cubic ft. might be tried to start with, and when the grapes are beginning to colour—a much safer period—¾ oz. is better. When the grapes have been picked 4 oz. per 1,000 cubic ft. can be used. These amounts will probably have to be increased, as many of the houses are far from gastight, a condition which renders the use of cyanide in vineries attached to or near dwellings a dangerous practice.

In every case a second fumigation after a period of about twelve days is necessary to kill the insects which may hatch out in the interval, as the gas does not apparently affect the eggs.

CONDITIONS AND APPLICATION.

Fumigation should be started one hour after sunset, and the house opened up in the morning before the sun strikes the vinery. Strong light combined with cyanide-gas causes burning of the foliage. The foliage should be dry, as moisture takes up the gas and the dilute acid causes burning. The soil of the vinery should be only slightly damp, and no standing water should be left in the house, as this would absorb the gas and weaken the dose. If the soil is dry, it can be watered not later than twenty-four hours before fumigation. The temperature should not be above 70° or below 55° F. A calm night is necessary for successful fumigation, as strong winds are apt to increase the leakage of gas.

Put the required quantity of calcium cyanide in a wide-mouthed jar, or, in the case of a long house, in several jars placed at intervals, and, walking from the closed end of the vinery, scatter the contents evenly over the soil; then close and lock the doors, placing a warning notice on them. As the gas is given off slowly from the calcium cyanide, there is ample time to scatter the chemical, without danger, at an ordinary walking-pace. The gas will have practically disappeared by the following morning.

To calculate the amount of calcium cyanide required measure the body of the house, which may be, say, 80 ft. long, 25 ft. wide, and 4 ft. high, which works out at 8,000 cubic ft. Then measure the top part of the house, taking a vertical line to the apex from a line drawn from top-plate to top-plate—say, 8 ft.—of which take half and multiply the square of the body by it: $80 \times 25 \times 4 = 8{,}000$ cubic ft. Then the total cubic contents of the house—8,000 plus 8,000 cubic ft.—equal 16,000 cubic ft.

Correction.—Referring to the list of imported grape-vines published in last month's *Journal* (page 107), the abbreviation "E" given at the head and used in the list stood for "a week *earlier* than 1"—not "later," as printed.

PREVENTION OF SAP-STAIN IN WHITE-PINE.

TESTS BY STATE FOREST SERVICE.

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(Concluded.)

TABLE 2 shows that none of the representative boards in the close-stacked treated pile showed stain until six weeks after the formation of the stack, when one of the boards was found to be lightly stained. During the next fortnight, however, the remaining representative boards all developed light stain, and from then on until the dismantling of the stack the increase in stain was very slight. The final examination, however, as shown in Table 5, revealed that 35·8 per cent. of the boards were blotched and 48·5 spotted. It was noticed that the boards in the top three layers were all badly stained, and this was probably due to the treating-solution having been washed off by the rain, thus reducing the treated material to the same conditions as experienced in the untreated stack, and making it very liable to attack. A proportion of 9·3 per cent. of the boards was entirely free from stain, and it appears that, had the stack been formed under cover, the staining would not have been severe. The depth of staining in this stack often occurred up to ½ in. in depth. Fig. 6 represents typical staining in the pile.

Table 2.—Occurrence of Sap-stain in Close-stacked Treated Pile.

(Five boards examined.)

Date.	Sap-stain Occurrence.
1927.	
2nd April ..	Stack formed.
9th April ..	Staining, nil.
16th April ..	,,
23rd April ..	,,
30th April ..	,,
7th May ..	,,
14th May ..	One board slightly spotted.
21st May ..	No increase in stain; timber still of good appearance; two boards lightly stained.
28th May ..	Four boards stained (one board unable to be removed), the stain appearing in streaks and blotches.
2nd July ..	No increase in stain.
30th July ..	Slight increase.
27th August ..	No increase.
24th September	,,
27th October ..	Very slight increase.

NOTE.—Overhanging ends of boards commenced to show staining on 16th April.

The history of the staining in the open-stacked untreated pile is shown in Table 3. Two of the representative boards had become

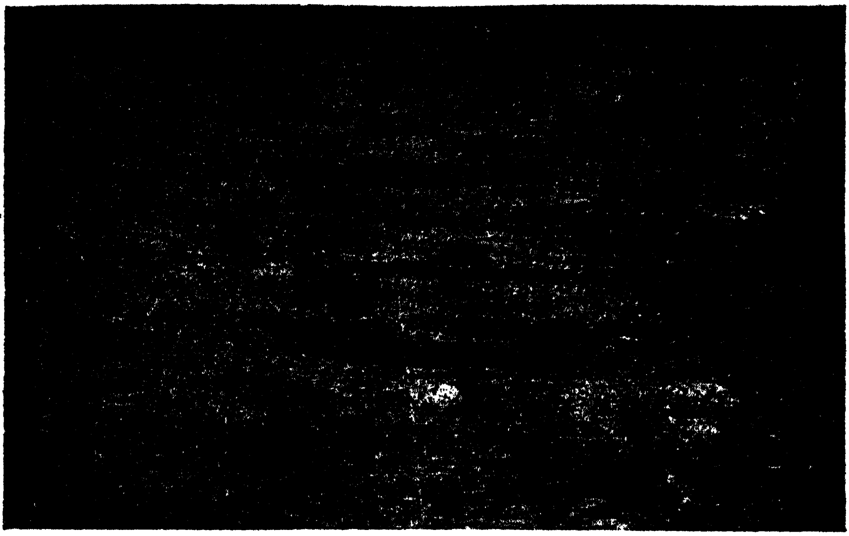

FIG. 6. TYPICAL STREAKED STAINING OCCURRING IN CLOSE-PILED TREATED STACK.

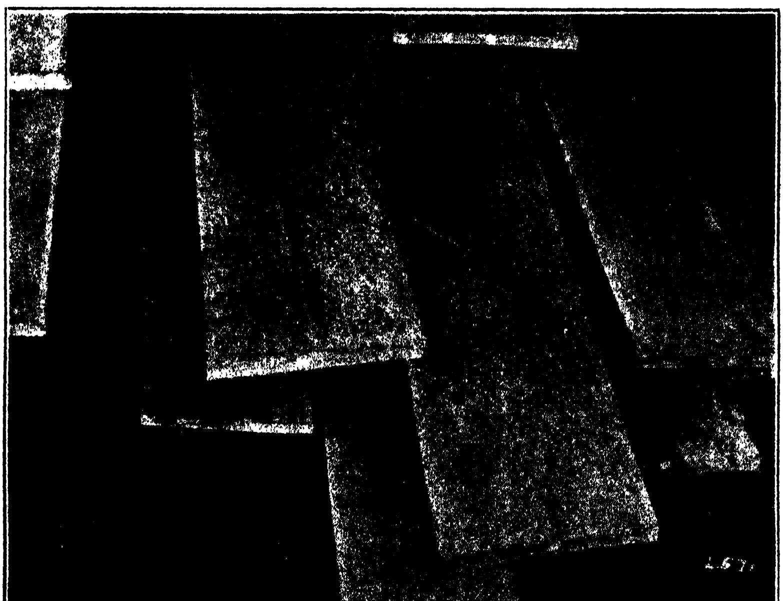

FIG. 7. OVERHANGING ENDS OF TIMBER BADLY SAP-STAINED.

Box-stacking overcomes this, due to the free ends of the timber occurring in centre of stack.

lightly spotted on both sides one week after the formation of the stack. The staining continued steadily for the next five weeks, at the end of which period four representative boards were lightly spotted and six boards heavily spotted on both sides. From then onwards until the dismantling of the stack, four months later, the staining showed but little increase. The final examination, as shown in Table 5, proved that the majority of the timber was still in very good condition, and that only 13·6 per cent. of the boards had been heavily spotted. The percentage of unstained timber was high, being 34·9 per cent., while lightly spotted timber, which would not degrade the timber at all, represented another 25·2 per cent. In all cases in this stack the maximum depth of the stain was less than $\frac{1}{16}$ in., and could be planed off with very little loss.

Table 3.—Occurrence of Sap-stain in Open-stacked Untreated Pile.

(Ten boards examined.)

Date.	Sap-stain Occurrence.
1927.	
1st April ..	Stack formed.
9th April ..	Two boards lightly spotted on both sides.
16th April ..	Three boards lightly spotted ; two boards thickly spotted on both sides.
23rd April ..	Six boards lightly spotted ; two boards thickly spotted on both sides.
30th April ..	Six boards lightly spotted ; three boards thickly spotted on both sides.
7th May ..	Five boards lightly spotted ; five boards thickly spotted on both sides.
14th May ..	Four boards lightly spotted ; six boards thickly spotted on both sides.
21st May ..	Slight increase in spotting.
28th May ..	Practically no increase in staining.
2nd July ..	No increase in stain.
30th July ..	,,
27th August ..	,,
24th September	,,
27th October ..	Slight increase in stain.

NOTE.—Stack sap-stained, but not so badly as the close-stacked untreated pile.

Table 4, which represents the condition of the representative boards in the open-piled treated stack, indicates that though a light staining appeared after six weeks there was no further increase in the stain during the whole period the timber was stacked. Reference to Table 5, representing the final detailed inspection, shows that 54 per cent. of the boards were unstained, 34·1 per cent. lightly stained, while only 4·6 per cent. exhibited heavy stain. In all cases it was proved that the stain was purely on the surface and had no measurable depth. It was also found that only top and edge boards were stained at all, and as these were subjected from time to time to heavy rain it is reasonable

to conclude that staining occurred only where the treating-solution had been washed off the boards. Boards in the interior of the stack were entirely free from stain.

Table 4.—Occurrence of Sap-stain in Open-piled Treated Stack.

(Ten boards examined.)

Date.	Sap-stain Occurrence.
1927.	
6th April ..	Stack formed.
16th April ..	Staining, nil.
23rd April ..	,,
30th April ..	,,
7th May ..	,,
14th May ..	,,
21st May ..	Two boards lightly spotted.
28th May ..	Only one board entirely free from stain; the stain on other boards very slight.
2nd July ..	No increase in stain.
30th July ..	Slight increase.
27th August ..	Very slight increase.
24th September	No increase.
27th October ..	Very slight increase.

A general examination of the four stacks indicated that the tendency is for spotting to occur on the exposed surfaces and blotching on the more sheltered surfaces. This is borne out by experience of timber stacked in any mill-yard. It is always noticed that the overhanging ends in the stacks are sap-stained in the form of spots. Blotches never occur in these cases. This also explains the freedom from blotches exhibited by both open-piled stacks. In these there were no sheltered surfaces, and, as a consequence, no blotches. In the close-stacked material, in which the surfaces of the various boards were in direct contact, blotching occurred very badly, and it is probable that the blotches developed from groups of spots which combined under conditions suitable for their growth into one large area. (Table 5, next page.)

In order to show clearly the effect of treating and open piling of the timber Table 6 was prepared. An examination of this table proves conclusively the great value of both the borax dip and the open piling of timber as a preventive of sap-stain. In the close-stacked untreated pile the percentage of unstained and lightly stained boards is as low as 19·3, with the moderately and heavily stained percentage as high as 80·7. The effect of open stacking and treating the timber is shown as a complete reversal of these figures, in that the percentage of unstained and lightly stained timber is now 88·1, while that of moderately and heavily stained timber is only 11·9. The other columns in the table show that both borax dipping of close-stacked timber and open piling of untreated timber are separately responsible for saving approximately 40 per cent. of the timber.

Table 5.—Results of the Final Inspection expressed as Percentages of the Total Number of Boards in each Stack.

Description.		Close-piled Untreated Stack.	Close-piled Treated Stack.	Open-piled Untreated Stack.	Open-piled Treated Stack.
Boards streaked ..	Lightly ..	0	1·4	0	0
	Moderately	0	5·0	0	0
	Heavily ..	0·7	0	0	0
Boards spotted ..	Lightly ..	9·3	34·3	22·0	3·0
	Moderately	13·6	7·1	19·2	0
	Heavily ..	7·1	7·1	10·6	1·9
Boards blotched ..	Lightly ..	9·3	12·9	3·2	31·1
	Moderately	32·8	17·9	7·1	7·3
	Heavily ..	26·5	5·0	3·0	2·7
Boards free from stain		0·7	9·3	34·9	54·0

Table 6.—Results of Final Inspection expressed as Percentages of the Total Number of Boards in each Stack. (Condensed from Table 5.)

Description.	Close-piled Untreated Stack.	Close-piled Treated Stack.	Open-piled Untreated Stack.	Open-piled Treated Stack.
Boards free from stain and lightly stained	19·3	57·9	60·1	88·1
Boards moderately and heavily stained	80·7	42·1	39·9	11·9

In all stacks, even the treated, the top two or three layers of boards were sap-stained. This was due in all cases of the treated timber to the washing-off of the solution by rain, and it is probable that the only way this could be overcome would be by roofing the stacks. This could be done cheaply at the mill by manufacturing temporary roofs from second-class boards by battening them together, and the protection of the timber from not only staining but checking would easily repay the cost. Fig. 9 shows boards from the top of the open-piled treated stack which had been badly sap-stained due to the washing-off of the solution by rain.

Cost and Application of the Treatment.

In the present study 36 lb. of borax, at a total cost of 14s., was used to treat 5,500 ft. B.M. of timber. After treatment it was found there was sufficient solution left to treat a further 10,000 ft. B.M., and on this basis the cost of the preservative is approximately 1d. per 100 ft. B.M. of timber treated. The tank and draining-platform, which would be constructed of timber at the mill, could be manufactured for approximately £10.

In small mills (cutting under 5,000 ft. B.M. per day) it would be quite possible and practicable for the yardman to attend to the dipping and draining of the timber as it came off the saw, thus reducing overhead and handling costs. In medium or large-sized mills, however, very probably an extra man would be required to carry out the treatment, thus increasing the cost by approximately 1d. to 2d. per 100 ft. B.M., depending on the size of the mill.

In large mechanized mills special apparatus could conveniently be installed. Two methods of dipping are practised. In the first the timber is forced under the surface of the solution by large wheels, while in the second the boards are allowed to drop into the solution and are hauled up the other side by means of travelling chains. These are the types of apparatus used in the southern United States of America, where dipping to prevent sap-stain is extensively carried out. No extra labour would be necessary to operate these plants, and the depreciation and power costs would amount to approximately 1d. per 100 ft. B.M.

The total cost of treating the timber will thus vary from 2d. to 3d. per 100 ft. B.M., depending on the methods of carrying out the operation.

FIG. 8. SAP-STAIN OCCURRING ON TOP BOARDS STACKED IN OPEN-FILLETED TREATED PILE.

Rain has washed off the treatment, allowing sap-staining fungi access to timber. Roofing of stacks would prevent this.

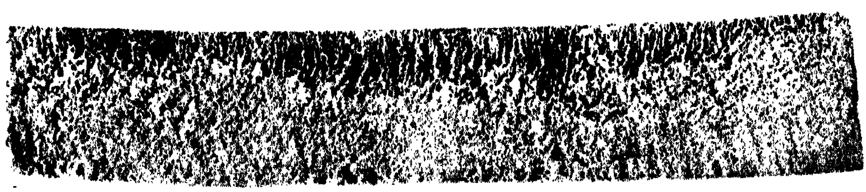

FIG. 9. TYPICAL DEPTH OF SAP-STAIN OCCURRING IN CLOSE-STACKED UNTREATED PILE.

Conclusions.

The results of the foregoing study may be summarized as follows :—

(1) There is no cure for sap-stain ; it must be prevented.

(2) Sap-stain attack may be retarded and almost eliminated by (*a*) dipping the timber in a borax bath, and (*b*) piling the timber in an approved fashion.

(3) Neither 2 (*a*) nor 2 (*b*) is in itself sufficient to prevent sap-stain attack. Both operations must be carried out in conjunction.

(4) The most efficient style of piling to adopt is the open-filleted box type. Open filleting prevents accumulation of moisture on the wood, while the box design leaves no overhanging ends on the stack. When stacks have overhanging ends these invariably become sap-stained

(5) Roofing of treated stacks is essential, in order to prevent the treatment being washed off by seasonal rains.

(6) Under no circumstances should the timber be left in a block-stacked condition for more than a few hours. In this condition the attack commences very quickly, and will continue despite precautions taken later.

Recommendations for Prevention of Sap-stain.

Having consideration to the various factors involved, the Forest Service recommends the treating of all white-pine sapwood immediately it comes off the saw, followed by stacking in approved fashion, whenever it is necessary to season the timber before it goes into actual use. This applies only, of course, to timbers used for purposes for which sap-stain is a defect.

The treatment consists of momentarily dipping the timber in a saturated solution of borax in water (2 per cent. at normal temperature). The piling recommended is the open-filleted box type. In this the stack is made up in the form of a box, two boards being used throughout the length of the pile, with their free ends occurring on the inside of the stack. The fillets should be not less than 2 in. wide by 1 in. thick, and should be spaced not more than 4 ft. apart. A 6 in. air-chimney should be provided at 2 ft. intervals in the width of the stack. Where possible the stack should be roofed over, the roof overhanging at least 1 ft around the stack. A section of the stack is shown in Fig. 3.

ACKNOWLEDGMENTS.

The following organizations have co-operated with the Forest Service in the work here described : Dairy Division, Department of Agriculture —general ; Diggers Sawmilling Co., Woodstock—land and facilities for carrying out the tests. Mr. W. C. Ward, of the Forest Service, co-operated in the presentation of the study.

REFERENCES.

(1) "The Control of Sap-stain, Mold, and Incipient Decay in Green Wood, with Special Reference to Vehicle Stock," by Nathaniel O. Howard, Pathologist, United States Department of Agriculture.

(2) "The Cause and Prevention of Sap-stain in White-pine," by J. S. Yeates, M.Sc. (unpublished report).

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

ESMOND ATKINSON, Biological Laboratory, Wellington.

SPEAR-GRASS (*STIPA SETACEA*).

THE grass illustrated in this article has been known in New Zealand for fifty years or more. It was first discovered in Otago, and was then thought to be an undescribed native species, being given the name of *Stipa Petriei.** Only after some time—when it had begun to spread considerably and showed unmistakable signs of being an introduced plant—was it found to be the same as the Australian *Stipa setacea.* Cheeseman (" Manual of the New Zealand Flora," 1906, p. 858) describes spear-grass under this name, but, while including it among the indigenous grasses, remarks: " A common Australian plant, stretching from Queensland to Tasmania. It is probably naturalized only in New Zealand." In the Appendix he says: " I have received numerous specimens of this plant from various localities on the east coast of the South Island from Marlborough to Otago. It is evidently spreading rapidly, and no doubt can be entertained of its exotic origin." In the second edition, of 1925, however, it is still included among the native species. Little has been heard of spear-grass as a weed in New Zealand (though in Australia it has proved troublesome from time to time) until within the last few years, when it has spread rapidly on Banks Peninsula and in the Marlborough Sounds. Lately there have been a good many inquiries about it at this Laboratory, on account of its danger in sheep-country.

Spear-grass is a striking plant when in flower, owing to the graceful, open head, with its unusually long awns. (The awn is the bristle-like attachment to the scale which forms part of the covering of the so-called " seed " in grasses.) Fig. *a* of the illustration shows the general appearance of a head, but larger ones than this, with many more flowers, are often seen. The whole grass is slender and wiry-looking (Fig. *d*), even the leaves being so, owing to their inturned edges. Fig. *b* shows (magnified) the junction of leaf and leaf-sheath with its tufts of hairs. At Fig. *c* (also magnified) is shown the " seed," sharply pointed at the lower part, and at the opposite end the base of the awn, which is spirally twisted.

It is these sharp-pointed " seeds," with their long twisted awns, that make spear-grass so troublesome a weed under certain conditions. The following quotation from Hilgendorf's " Weeds of New Zealand " (p. 27) gives a very clear idea of the actual damage done: " Each seed has a very sharp spike, and the twisted awn helps to drive this spike into sheep's wool. The seed sometimes penetrates the pelt, and embeds itself in the subcutaneous muscle, entirely spoiling the appearance of the carcase. An area of 3 square inches of the surface muscle of a sheep killed at Picton works was found to contain thirty-three seeds of spear-grass. The tails had broken off as the seed had passed through the skin, and only the heads were embedded in the muscle. The pain, and consequent loss of condition, to the sheep must have been

* Buchanan: "New Zealand Grasses," Plate 17, ii.

SPEAR-GRASS.

(*a*) Flowering head, natural size; (*b*) junction of leaf and sheath, showing tuft of hairs, enlarged; (*c*) seed, showing twisted base of awn, enlarged; (*d*) small piece of tussock, natural size.

[*Drawing by Esmond Atkinson.*

very serious. It appears that only occasionally does the seed ripen hard enough to act in this manner, because in some cases where spear-grass is found the sheep are not affected."

This article is written primarily with the idea of showing what spear-grass is like to look at, so that where it has only recently made its appearance there may be no delay in recognizing it. It is too early as yet to formulate any definite rule for combating the weed, but the owners of country where spear-grass is spreading are likely to have noticed many points about its behaviour under varying conditions. The possession of such facts from a wide range of country would, when they were correlated, certainly be of great value in dealing with a weed like spear-grass, and any information sent in to the Department of Agriculture would be appreciated.

SO-CALLED BLACK LOGANBERRY: A WARNING.

A PLANT known as "black loganberry" has been raised and distributed by at least one nursery firm in New Zealand, with the idea that something in advance of the common loganberry had been secured. Doubtless this was done in good faith, but the firm chiefly concerned, as well as other persons who have had experience with the plant as a commercial proposition, now realize that to continue with it means trouble for the future, without expectation of any reasonable present recompense. The plant not only fails to set fruit satisfactorily, but has the spreading propensities of blackberry, and is almost as difficult to eradicate. This note of warning is therefore issued for the information of any would-be growers.—*J. A. Campbell, Director, Horticulture Division.*

IRRIGATION STATISTICS.

THE collection of particulars relative to irrigated land in New Zealand was introduced in the 1925–26 season, and the figures are now published for the first time, together with those for the succeeding season. It will be seen that the total area irrigated increased by 8,951 acres, this being accounted for by an almost corresponding increase in the area of irrigated pasture land. A comparison of both years is given in the following table :—

Irrigated Land and Crops.	Area irrigated.	
	1925–26.	1926–27.
	Acres.	Acres.
Orchards	2,066	2,027
Green fodder and root crops	1,840	2,273
Pasture	42,380	49,942
Lucerne	784	2,165
Oat	778	428
Wheat	62	65
Barley	17	58
Market gardens	74	29
Other crops	81	46
Totals	48,082	57,033

—*Census and Statistics Office.*

SEASONAL NOTES.

THE FARM.

AUTUMN- AND WINTER-SOWN CEREALS.

In the South Island the period for sowing autumn and winter cereals extends from the end of April to about the middle of June. Oats are usually sown from the end of April to the end of May, and wheat during May and the early part of June. Sowing in July is generally avoided. Spring sowing takes place in August and September, the cereal usually following turnips fed off in the winter. The extended period in which cereals are sown allows an even distribution of team labour over the autumn, winter, and spring months; it extends the period of harvesting from early January to the end of February, and thus allows the crops to be harvested without any undue rush. Also, the autumn-sown cereals provide valuable feed in the spring for breeding-ewes, after the turnips are finished and before the spring growth of grass starts.

In the North Island and the far south of the South Island cereals are generally spring-sown; in both areas the cereal crop usually follows turnips. In the North Island autumn-sown cereals generally run too much to straw, are liable to rust, and, ripening early, they require harvesting during the haymaking-period, which congests the farm-work at that time. In the far south the low winter temperatures render it inadvisable to sow in the autumn.

Wheat.

The main wheat-growing areas of New Zealand are situated on the plains and rolling downs of Canterbury and North Otago. The soils best suited to the growth of wheat are those of the heavier description, such as well-drained clay soils. The average wheat-growing soil of Canterbury is a good, free-working loam overlying a clay subsoil, but the best yields are usually obtained from the leavy loams.

Place in rotation: Autumn- and winter-sown wheat can be taken after grass or clover, rape, cereal, peas, potatoes, and linseed. The crop usually does best after clover or rape; if taken after grass the land should be skimmed early to allow the sod to rot before the wheat is sown. Good crops are often obtained after potatoes, provided sowing is not unduly late. Wheat is often taken after wheat or oats, with quite good results on strong land, but the second crop should be well manured.

Cultivation: Wheat requires a fine, firm seed-bed—the fine soil at the bottom and the clods at the top. Small lumps on the surface of a field of autumn-sown wheat are no disadvantage; the clods break down in the winter and provide a loose surface, preventing the land from caking hard in the early spring. Grassland intended for wheat should be skim-ploughed any time between the end of November and the middle of March. After lying for about six weeks the surface should be disked and the land cross-ploughed 6 in. or 7 in. deep. The surface can then be levelled with the harrows, and the final tilth given

with the disks and harrows. The cultivator should not be used, as it is inclined to drag any undecayed vegetation to the surface. The two ploughings of grassland for wheat are very necessary, in order to allow the vegetation to decay and to obtain a fine, firm seed-bed. Early skim-ploughing gives virtually a summer fallow, and allows the land to absorb the autumn rains. Land after peas, rape, linseed, or a cereal can be worked down after ploughing with the harrows, disks, and cultivator. The cultivator is a necessary implement when the land is cloddy, as it brings the clods to the surface and shakes the fine soil to the bottom, thus making a good seed-bed for the crop. Care should be exercised in the use of the roller on wheat-land for breaking clods, as it is liable to consolidate the surface and cause it to set. If the roller is used it should be followed with the cultivator to loosen the surface again.

Manuring: The crop should be manured with 1 cwt. of superphosphate or basic super. Although recent experiments have shown that this quantity of fertilizer will give increased yields of up to 4 or 5 bushels per acre, a very large area of wheat is, unfortunately, annually sown without any manure.

Varieties: The common varieties of wheat sown in New Zealand wheat-growing areas are Solid-straw Tuscan, Hunter's, and Velvet Chaff Pearl. Solid-straw Tuscan is the best wheat for windy districts, as the straw is filled with pith and is very rigid, so that it does not thresh about in the wind. Hunter's is a popular variety for medium wheat-growing soils; it yields well, produces a large amount of green feed, and can be fed off fairly close. Velvet Chaff Pearl is a wheat of very high milling-quality, but is only grown on medium land of even quality where the whole crop will ripen at once, as the grain is loose in the chaff and liable to shake.

Seeding: For autumn and winter sowing the seeding varies from 1¼ to 1½ bushels. The seed should be pickled for stinking-smut before sowing. The common practice is to use the formalin pickle on the farms, but a good deal of seed is now treated in bulk with copper carbonate. The latter method consists in dry-dusting very finely divided copper carbonate on to the wheat at the rate of 2 oz. per bushel. As the powder is poisonous if breathed in quantity, the dusting is usually done in a closed rotating cylinder. The advantages of this method are that large quantities of seed can be treated by machinery at seed-cleaning plants, the seed may be treated any time before sowing, and the germination is in no way injured.

Drainage: Wheat will not stand flooding to any extent in the winter-time. Any hollows in the wheatfields should have surface drains made from them to carry off any standing water that may collect after rain.

Oats and Barley.

Autumn oats usually follow a cereal or an early fed-off fodder crop. The seed-bed requirements are similar to those already mentioned for the wheat crop. Algerians for chaff and Gartons for grain are the common varieties sown in the autumn. Both varieties produce very palatable green feed in the spring; Algerians can be fed off with the greatest severity, but Gartons should be quickly eaten down once and then left alone. The autumn seeding is 1½ to 2 bushels, and the

crop, especially if taken on stubble land, should receive 1 cwt. per acre of super or basic super.

On North Island dairy farms oats are sometimes grown as a catch-crop for spring green feed. This season root crops have either failed altogether or have only done moderately well, and feed will probably be scarce in the winter and early spring. Any vacant land could with advantage be sown in Algerian oats for spring feeding, and the crop followed with root and forage crops later in the year. Although the yield of green oats is not particularly high, the crop is of very high feeding-value and is excellent for milk-production. For green feed sow 2 bushels of Algerian oats with 2 cwt. of super per acre. Barley is sometimes used for spring green feed, but it does not yield as well as oats, nor is it as palatable ; barley if fed when running up to seed causes digestive troubles in cows, and cows are frequently poisoned feeding off partly matured barley.

Barley for malting is sometimes sown in the autumn, but care must be taken that the land selected is perfectly dry in the winter, as barley is killed out if the land is subject to winter flooding.

TOP-DRESSING OF PASTURES.

Top-dressing in April and May increases the winter growth of grass. This year pastures in most dairying districts have suffered severely during the dry weather, and will require careful handling to get them back into good condition. Bare spaces in pastures, unless they can be covered with a clover growth, will eventually grow weeds, and the sooner the top-dressing is put on the better chance white clover has of gaining supremacy. White clover shades the surface of the ground and allows the stunted grass-plants to root again and start growth.

Superphosphate is the best fertilizer for autumn top-dressing, as it is quick in action and forces the grass and clover along while the soil-conditions are still suitable for growth. The quantity to be applied depends on whether the pastures are top-dressed once or twice a year. If only once, then 3 cwt. should be applied ; but if twice, 2 cwt. in the autumn and 2 cwt. again in the spring are the usual quantities. Autumn is the best period for dealing with top-dressing work on hill country, as it allows the best use to be made of fine weather. Later, when the hills become wet and slippery, great difficulty is often experienced in getting the material on to the ground, and the cost of applying is materially increased.

—*P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.*

THE ORCHARD.

EXPORT WORK.

In picking all varieties for export two main essentials have to be kept prominently under observation—namely, colour requirements and stage of maturity. Neither should be sacrificed for the other in any instance. Every effort should be made to get the fruit picked at the right stage, and despatched as soon as possible after it is picked. Allowing fruit to remain in the shed—either before or after packing—is detrimental, and detracts from general appearance.

Careful handling of fruit for export may still be emphasized, there being signs of damage in many lines now coming forward for examination. Attention must be called to the possible damage to apples at the sides of the cases when packing with the high bulge recommended this season. Much of this can be alleviated by a slight pressure of the apples towards the centre of the case before putting the lid on. Apples packed high at the ends of the case are very liable to be bruised. A good practice is to pack the first few apples in the case—or even half the tier—with the calyx towards the packer, reversing this at the other end. This applies more to apples slightly conical in shape. The result will be a solid pack in the centre of the case, with very little chance of sinking, while the apples at the ends of the case will be somewhat lower than the centre, enabling the lid to be put on with the minimum amount of pressure and very little, if any, bruising.

The overlapping of varieties—especially Jonathan and Delicious—sometimes leads to trouble, the tendency being to pick the Jonathans too green and with little or no colour, in order to get rid of them before starting on the Delicious. This should be guarded against. Growers should study the regulations, paying careful attention to the colour requirements for each grade before picking.

The packing of pears for export requires every care. It is not the number of pears in the tray, but the condition on arrival, that sets the price. Consequently grade and pack carefully, using an ample supply of wood-wool, so that there will be no fear of the pears bruising in transit.

COOL STORAGE FOR LOCAL MARKET.

Growers intending to cool-store apples for the local market will be well advised to treat such fruit as carefully as that intended for export. It must be realized that only good, sound fruit can be expected to keep in cool store over a long period. Damaged fruit when put into store can never come out sound. On the other hand, the rots set up by the damaged fruit often spread throughout the case. It is a waste of money to pay storage charges on fruit that should have been sent to the jam-factories or given to the pigs. The aim should be to pack out from cool store as many cases as put in, and this can only be done where the handling and packing have been of the best. Periodical examining of fruit in cool store should be undertaken, so that each variety may be placed on the local market in the best possible condition.

ORDINARY ORCHARD STORES.

Quite a number of these home-made stores have been erected in different fruitgrowing districts, and have proved successful. Although the fruit cannot be kept in them for such a long period as in mechanical cool stores, yet a glut on the market can be often avoided by their means. Some growers are apt to place very inferior fruit in these stores. This is not advisable, conditions being more favourable for decay, and consequently rots spread faster. The question of ventilation is very important in this class of store, and ample should be provided in order to allow for the elimination of gases that accumulate. Stacking should be done so as to allow free access of air all round the cases, and humidity should be attended to.

—*G Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

After such a prolonged dry spell, followed by late summer rains, the trees will rapidly put forth new growth. This growth will be softer than in normal seasons, and more disposed to suffer from even light frosts in winter. For this reason nitrogenous fertilizers are better withheld, as they will tend to make the growth even more succulent. Potassic or phosphatic fertilizers will be required, and if any nitrogen is used it should be slow-acting. Superphosphate, 8 cwt., plus sulphate of potash, 2 cwt., per acre, is a good dressing to meet most cases.

There are many citrus-groves which will naturally benefit by an application of lime. Where no lime has been applied for many years, 1 ton per acre, to be followed by ½ ton every third year, is correct. Where such a dressing of lime is made, applications of artificial manures should be deferred until later.

Autumn working of the land should aim at keeping the soil from consolidating on the surface, and so arranging the contour as to provide an easy get-away for the heavy rains expected later. Unless this is done prior to sowing a green crop it is rarely possible to do it later, and water stagnates in odd places, to the detriment of the trees.

After thus preparing the land it is seasonable to sow a green cover-crop. Blue lupins are ideal for the purpose, and provide the largest quantity of green material to turn under later. Oats and tares or Lotus angustissimus are also quite good. Super or lime, whichever is being used, should be used at sowing-time; but where lime is used the super should be applied later, when the crop is turned under.

There will now be a certain amount of pruning required. First, the worn-out parts of fruiting-wood should be removed, as also all dead wood. When dealt with at this season these are more readily discernible than will be the case later, when the trees are in full vegetation. All branches which sweep the ground or hang within 1 ft. of the soil should be cut away, as it is on these that spores of citrus brown-rot first find lodgment.

The loss from this brown-rot is great every year, varying in severity according to the continuity of rainfall, but even under the best conditions it causes quite sufficient loss to justify preventive measures. These are really of a threefold character: Firstly, sterilization of the soil, where the spores reside. This is usually done with sulphate of iron, 2 lb. per tree, worked into the surface soil; but White Island No. 1 Product, 3 cwt. per acre, is in many cases giving even better results, as it not only contains various forms of iron, but sulphur and other elements which correct chlorosis and give general tone to the trees. Secondly, pruning away lower branches, so that spores missed by the sterilization will not be so readily lodged on the trees by rain-splashes from the soil. A cover-crop of green growth under the trees is also beneficial, as it acts as a carpet against splash. Thirdly, an application of bordeaux, 4-4-40, to the trees in late autumn, which acts as a preventive to the establishment of such spores as may chance to alight on the covered parts. In certain localities where the disease is not troublesome, or in seasons of lesser severity, part of this threefold treatment may suffice, but it is well to be prepared in its entirety.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

THE WINTER LAYERS.

On most poultry plants the great majority of the adult hens will now be preparing for or passing through the moulting process. Consequently in most cases they will not come into profit again till the end of winter or early spring. Obviously, now is the time when the pullets must be looked upon to fill the egg-basket, and for this reason the chief concern of the poultry-keeper during the next few weeks should be to give the pullets the best possible management, in order that they may produce to their maximum capacity. In the first place, the greatest care must be taken to prevent them going into a moult. Reference is, of course, made to the pullet which has been bred to lay in winter and is now about six months old. It is realized that the great bulk of the early-hatched birds which have been producing for several weeks will now be moulting or be on the point of it, and this in spite of anything that can be done for them. In the case of pullets which have only just started to lay, or which are on the point of laying, it is entirely different. If these young birds are given proper management they should not moult until next autumn, and will continue producing till that period. On the other hand, if they are subjected to improper treatment now or in the near future it is more than likely that they will moult with their elder sisters, and at the expense of the anticipated winter egg returns.

The first thing necessary to prevent the pullets which were hatched out to lay in winter from moulting at present is to provide them with every favouring condition; above all, the management they receive must be uniform to a degree. They should be placed in their winter quarters well before the laying-period commences—this in order that they may get over the changed conditions and feel at home before commencing to lay.

A change of food will usually upset any laying flock, but this applies with double force when young pullets are concerned, having the effect of putting the birds into a premature moult. There is no doubt that sudden changing of food and quarters is more responsible for pullets going into an early moult than any other cause. Not only does the maintenance of one diet often prevent a false moult, but it also encourages a bird to maintain maximum production. That laying birds require frequent changes of diet is one of the theories which does not hold good where pullets are concerned. Laying pullets should not only be provided with a liberal and uniform class of food at regular periods, but in addition it should be of a high-grade character. Beware of poor-quality foodstuffs, especially when the feeding of the pullets is being considered.

Some of the so-called pollard and, indeed, wheatmeal which is being offered to poultry-keepers is next to useless for promoting winter egg-production. In buying food the best is always the cheapest in the long-run, even if its cost is a little greater. It should be remembered that one egg in winter is worth two in summer, and that any additional cost in securing the winter egg is more than paid back by the increased price obtained for it.

In order to obtain a heavy winter egg-yield, animal food, such as boiled meat or its substitutes—blood or meat-meal—is essential. Where milk is available this may to a great degree take the place of meat. Sharp gravel-grit, crushed oyster-shell, and clean water should be always available to the birds. The house should have ample room—not merely enough for the birds to roost in by night, but sufficiently large to accommodate and provide exercise in comfort during unfavourable weather. Exercise is a most important matter, and the best way of inducing this is to cover the floor of the house with litter, in which the grain foods should always be scattered. It is also a wise course to feed the birds in the house at all times, as waiting about in the yard for feeding-time on cold, wet days is not conducive to heavy laying. It is only the pullet provided with dry footing, both by day and night, that can possibly give her maximum egg-yield during the winter months. In short, everything should be done to provide as near as possible conditions similar to those which prevail during spring and summer—the natural laying season for bird-life.

MORE ABOUT CULLING.

On well-managed poultry plants the chief culling of undesirable stock will already have been carried out, but this is not to say that further culling is unnecessary. Indeed, if the best results are to be obtained the weeding-out of inferior birds should be done to a more or less extent throughout the whole year. It is a mistake (although a common one) to conclude that because the weak specimens have been eliminated from the flock in, say, February or March all the remaining stock on the plant will pay to keep for another year. It should be remembered that every inferior bird retained on the plant is a drain on the profits made from the heavy layers, and when the drones are in good numbers they may easily make the difference between success and failure. The keen poultry-keeper is always on the alert when working among his flock to detect birds which give evidence that they have passed their best period of usefulness. A fowl may give every indication during the autumn months that it will be profitable to keep for another year, but there is no telling when, owing perhaps to some abnormal internal condition, or through impaired vigour due to strain brought about by heavy egg-production, the same bird, in the eye of the practical man, will instantly be declared a cull.

In these days of high-priced foodstuffs the hard maxim should always be applied that when a bird is not paying its way, nor likely to in the future, it should be got rid of. Again, any bird must be regarded as useless if it does not possess the desired constitution, as it will then not be able to maintain its laying-power for any lengthened period, while, worst of all, it is always specially susceptible to disease and parasitic infection.

To the student of egg-producing form a striking illustration of the type of bird desired may be seen towards the close of a year's egg-laying competition. Having the available individual egg records to date of birds representing noted breeders from practically all parts of the Dominion, an opportunity is afforded of not only studying egg-laying performance, but also the external signs indicative of high,

medium, or low egg-laying capacity. The birds in the running towards the end practically all bear a somewhat similar general appearance, having an oblong tapering body (broad and deep behind), and a well-developed crop, running to a fine neck, carrying a clean alert head, also flat-boned legs set well to the rear and wide apart. The feathering is tight, and the birds are thickly clothed all over, or what is known as "hard" feathered. They also look full of life, and in many cases bear every indication of laying-power and the ability to maintain it to the end.

Where small nest-boxes are used the tails of these good laying birds will be more or less broken, and in some cases worn down to a stump. Obviously, the more often a bird visits its nest the more ragged or worn the tail becomes. These leading birds are constantly on the move, and although they possess their old feathers and worn-down tails they present a strong appearance.

Perhaps the strongest point to be observed about these birds that are fighting out a finish in the competition is that they are too busy to go into a deep moult. They usually moult by degrees, and continue laying at the same time. Any feathers cast are rapidly replaced by new ones, until by degrees a new and complete plumage is produced. To the unobservant eye, however, such a gradual moult would never be noticed. The weak pens, on the other hand, will have gone through their moult and be carrying their new plumage. Obviously, the latter type have been resting while the late moulters have continued producing, and doing this at a time when the market price of eggs is on the up grade. Not only this, but it will usually be found that the leading birds and late moulters will be laying again before or as soon as those which have moulted early.

It is not advisable, however, to choose breeders on late moulting and laying points alone, for the late moulter, or, indeed, the best layer, is not necessarily a desirable breeding specimen. In selecting hens for breeding purposes, points bearing on production-capacity are matters of prime importance; but in combination with these the birds should possess breed-type and conform to standard weight requirements of their breed if a heavy-producing strain is to be built up and maintained. Even at the termination of egg-laying competitions it is not uncommon to see in the front rank of performers more or less weedy specimens of the breed they represent. Some are practically broken down, owing to the year's egg-laying having impaired their constitutional vigour. On the other hand, birds are to be seen that are probably only a few eggs behind the others, but have ample "timber," with good breed-type and constitutional points stamped all over them. Obviously, specimens in the former category could not be expected to produce desirable progeny. After all, in poultry-keeping it is not the fact of having an odd phenomenal producer that spells success, but rather the possession of a good average laying flock. This can be maintained only by a sound system of breeding, feeding, and general management. Breeding from birds on egg-laying performance alone will not attain the objective.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

AUTUMN OPERATIONS.

By the time these notes are in print the month of March will be well advanced, and beekeepers will be fully occupied in doing the last of their honey-extracting and preparing their colonies for the winter.

Should the autumn be mild, final extracting may be later than usual on account of a prolonged flow of nectar. Thistles will probably yield more nectar at this period than other plants, and will, when mixed with clover or catsear, produce a white, clear, and delicately flavoured honey which forms a splendid exporting article.

Should late extracting be necessary, great care must be taken to check robbing ; an apiary may soon become demoralized if precautionary measures are not taken. When once robbing starts it may prove a difficult matter to stop. Thousands of bees may be killed by endeavouring to enter the wrong hives, and thereby the strength of the colonies be very much weakened ; or the colonies may even be rendered incapable of going through the winter. When robbing has commenced, do not open any more hives until the trouble is controlled. This may be done by syringing the entrances of the offending hives with water, and in bad cases by placing wet grass over the entrances until the disturbance has been quelled. Do not on any account leave combs of honey open to attack, or keep a hive open an instant longer than necessary. If the colony attacked should be weak, contract the entrance in addition to the above-mentioned precautions. It may be necessary to suspend work in the apiary during the day, doing as much as is thought advisable in the early morning.

FOUL-BROOD.

At all times of the year foul-brood is a menace to the beekeeping industry, and it is advisable to always keep a sharp lookout for any symptoms. This is especially the case during the spring and autumn months ; and before pronouncing any colony fit for wintering the brood-nest should be carefully examined for the slightest sign of the disease. If a trace is discovered, or the disease is found in a more advanced state, judgment must be used as to the advisability of destroying the colony completely or of treating it.

WINTER STORES.

As advised last month, do not fail to determine the quantity of stores available in the hives for winter consumption. A plentiful supply is sound economy, and my advice is that not less than 30 lb. of honey be left in each hive. There are occasions when late swarms have not gathered sufficient for their own wintering purposes, and then they must be fed either with clean, healthy honey, or with sugar-syrup. Never use honey from an unknown source.

CLEANLINESS AND ORDER.

Before finally leaving the hives for winter it is a good plan to scrape the bottom-boards free of all the rubbish that has accumulated during the summer, thereby helping to keep the bees in a healthy condition. Also scrape the alighting-boards clean, and clear any

long grass surrounding the hives; this will tend to keep away dampness. The hives should be placed on blocks several inches off the ground, and in a sheltered position where they may receive a considerable portion of the day's sunshine. Any leaky covers or split supers should be removed from the hives, and sound ones put in their place. Remember bees require dryness and warmth.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

TOBACCO-LEAF.

THE operation of harvesting the tobacco crop will now be nearing completion—indeed, much of the leaf is already cured. On this point it is well to be certain, as unless the leaf-stems are well dried out there is a danger of them mildewing. After curing, the sooner the leaves are stripped from the plant-stalks the better. Commence by conditioning the leaf—that is, admit or create a damp atmosphere, the result of which will quickly be seen by the blade of the leaf becoming flaccid and soft. In this condition only may it be handled without damage. The neglect of this precaution is the cause of considerable loss by depreciation every year. The method, then, is to take the stalk in the left hand and strip the leaves carefully without damage. Meanwhile examine the leaf and place it in its special grade. A dozen or so of the leaves are then taken, and the butts of the stems are bound with a tobacco-leaf used as a tie, which is finished by the stem end being tucked through the centre of the butts. In this way all the leaves are made up into "hands." The grades adopted depend on the purpose for which the leaf is to be used and the market, but generally it is based on colour and quality. The unbroken leaves of best quality are usually found about the middle of the stalk. Keep the grades separate.

When enough grade leaf has been accumulated it should be baled, branded, and consigned. In doing this care is again necessary to see that the leaf is in right condition. Putting dry leaf into slack bales is a poor way of treating a crop that has cost so much labour. To prevent breaking the leaves they should be just sufficiently damp to be pliable. Build the bales in a press and make them sufficiently firm to avoid movement within the bale when it is handled.

Where the grower decides to hold the leaf it is important to avoid holding it in a shed subject to extreme changes in weather conditions. Tobacco is a product that requires good storage. In most cases it would probably be best to bulk the leaf on a platform and cover it securely with a canvas cover. In doing this there should be no attempt to carry out a fermentation of the bulk, and, in any case, the tobacco should be examined frequently at first, in order to see that a high temperature does not develop.

TREATMENT OF TOMATO AREAS.

The outdoor tomato crop will soon be finished, and where it is desired to replant the land with this crop next season it is specially desirable to promptly and carefully clean up and burn the remains of the old crop—roots and tops. The practice of some growers to sow

down the area between the rows with a cover-crop in the autumn is much to be recommended. The old tomato-plants can then be lifted, and the cover-crop remains to mature. In these motor-car days, when strawy manure is not available, the green cover-crop is the only alternative method for conveniently supplying humus—that is, carbon, fibre, nitrogen, &c.—to the soil, raising the temperature, improving its mechanical condition, and supplying an ingredient that is otherwise very expensive.

SMALL-FRUITS AND NUTS.

Plantings of strawberries in their second or third year should now be making a good recovery after the cropping season. Take the opportunity every fine spell offers of putting the hoe through this crop and keeping the weeds down.

Cape and Chinese gooseberries, tree-tomatoes, passion-fruit, walnuts, hazelnuts, chestnuts, and almonds will now be ripening. Do not let the nuts lie on the ground long enough to discolour. A good method often is to lay a cloth round a tree and shake the branches with a pole, when all nuts near maturity will fall and are easily gathered. If this is done at short intervals the harvesting is greatly simplified. Spread the nuts in trays in a dry airy position and dry them up well, going through them occasionally and stirring them over. In this way rancid and mildewed nuts will be avoided. Riddles will afterwards take out small nuts and waste, and a little hand-picking should then produce samples that are satisfactory. Some of these crops can be grown in odd corners and waste spaces; they are worth more consideration than is commonly given in this country.

VEGETABLE CROPS.

The dry summer experienced will be responsible for rather a lean time so far as winter vegetables are concerned. The quantity will be short and the quality not quite up to the usual standard. Savoy cabbages planted shortly before Christmas are among the best in that line. They had the benefit of some rain and got established before the dry weather. Moulding of the celery crop should now be finished. Spring cabbage can be planted out

Sow cabbage, cauliflower, and lettuce for planting out in early spring. The lettuce seedlings often suffer from "rust" if the winter season is severe. The best preventive is to give them the shelter of a cold frame; but here again is a danger of "damping off"—a trouble that is sometimes severe and often not perceived until the plants are put out. In the winter keep the foliage of these plants dry, but give them plenty of air. Sow rather thinly.

Harvesting marrows, pumpkins, onions, and potatoes will make the coming month a busy one for many. Consider each crop carefully, and decide if it is suitable for long storage; grade it well and give it good accommodation.

SOIL COMPOSTS AND LIME.

The question of the use of quicklime as an ingredient in the compost-heap has been raised recently. Quicklime, like everything else, is under certain circumstances of very great value, and under others it is the cause of injury and loss. It is of value as an addition to a drained swamp soil that is heavily charged with humus. Its effect there will

be to further decompose the humus and liberate the nitrogen, correct acidity, and so permit the operation of the bacteria of fermentation which transform the nitrogen into nitrates, a soluble form in which it is immediately available to the plant. It must also be realized that lime is readily washed from the soil. Its mechanical effect on a stiff, heavy soil inclined to clod is well known. Again, some plants have a strong partiality for lime—the legumes, for instance. But where quick-lime forms an ingredient with animal manures or sulphate of ammonia in composts its effect causes great loss owing to its rapid action in liberating the nitrogen as ammonia-gas. Also, it is to be remembered that an alkaline soil is unsuitable for some plants, and, as it appears from recent experiments, striking cuttings.

For agricultural purposes quicklime is rarely used as it comes from the limekilns. It is then a lime oxide, and is usually exposed to the atmosphere, from which it slowly draws moisture, which causes the burnt rock to crumble. It is then lime hydrate and in a suitable state for adding to the soil. For light soils lime carbonate ground fine—that is, lime in its natural state—is often preferred. The outstanding effect in the use of quicklime is its rapid action in decomposing organic material, an effect that is useful in horticulture when operated in moderation. Excessive use just means burning up important plant-foods to waste.

—*W. C. Hyde, Horticulturist, Wellington.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st December, 1927, to 8th March, 1928, include the following of agricultural interest :—

No. 57002 : Treatment of natural phosphates; F. G. Shepheard, Penrose. No. 57502 : Leg-rope support ; G. T. Arcus, Levin. No. 58001 : Separator-driving device ; Aktiebolagat Separator, Stockholm. No. 58806 : Fence-dropper ; A. Arthur, Sydney, N.S.W. No. 58845 : Packing-case for eggs ; R. Hall, Hobart, Tasmania. No. 59282 : Cool-chamber louvers ; J. M. Maxwell, Dunedin. No. 59311 : Milking-cup ; O. A. Bruun, Copenhagen, Denmark. No. 59428 : Shaping butter by extrusion ; Toledo-Berkel Proprietary, Melbourne, Vic. No. 59573 : Butter-churn conveying element ; J. O. Connell and H. H. Kerr, Kensington, Vic. No. 59586 : Ploughshare ; J. R. Taylor, Duntroon. No. 56587 : Wire-strainer ; E. Cairn and J. B. Dunning, Pembroke. No. 57345 : Poultry-food preparation ; E. G. Schmoll, Hastings, and C. L. Schmoll, Napier. No. 58024 : Scutching-machine ; M. H. Wynyard, Auckland. No. 56822 : Scarifier ; N. McEwan, Wyndham. No. 57387 : Sterilizing cow-udders ; S. Finch, Ohingaiti. No. 57921 : Cream-cooler ; S. Armstrong, Tuhikaramea. No. 58291 : Washing fibre; J. R. Hynes, Foxton. No. 58294 : Electrification of seeds ; J. Christofleau, La Queue-les-Yvelines, France. No. 58900 : Milk-cooler ; C. Cooper, Eltham. No. 59236 : Manure-drill ; C. Topham, Kaikohe. No. 59309 : Sheep-shear tension-nut ; R. A. Lister and Co., Ltd., Dursley, England. No. 59404 : Pasteurizing-apparatus ; Creamery Package Manufacturing Co., Chicago, U.S.A.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

Fruit-export Control Board.—Mr. J. L. Brown, of Redwood's Valley, Nelson, has been appointed a deputy member of the Board to act for Mr. H. E. Stephens while the latter is absent in Britain as marketing representative.

TESTING OF PUREBRED DAIRY COWS.

FEBRUARY CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list gives particulars of cows which received certificates during the month of February.

Interested readers will be aware that the annual review of the C.O.R. system is usually published in the March issue of the *Journal*. Each year, however, there is difficulty in getting a certain number of owners to advise dates of calving subsequent to test, and also to return necessary declarations for cows already qualified. This year the difficulty has become accentuated, and it has therefore not been possible to compile the review for the year 1927 in time for the present issue. It is hoped, however, that all outstanding particulars will be to hand in sufficient time for the review to appear in the April *Journal*.

LIST OF CERTIFICATES ISSUED, FEBRUARY, 1928.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Ngahiwi Miss Romance	W. J. Freeth, Waitara	1 348	240·5	348	8,935·0	545·56
Orange Dale Rower's Fancy	W. J. Hall and Son, Matatoki	1 348	240·5	365	8,213·5	460·03
Briar's Ladylove	J. K. Watson, Tatuanui	1 247	240·5	365	7,720·6	450·55
Ngahiwi Prude	W. J. Freeth, Waitara	2 13	241·8	365	8,515·3	444·81
Springhill Juno	A. J. Harris, Bombay	2 32	243·7	365	6,595·8	433·24
Uruti Olga	W. Oxenham, Uruti	1 344	240·5	350	6,705·6	425·27
Fern's Heroine	C. Parker, Hairini	1 287	240·5	365	7,298·3	423·98
Twylish Rose	G. S. Clarke, Te Awamutu	2 16	242·1	365	7,722·9	419·66
Junette	E. O. Jepson, Te Awamutu	2 42	244·7	340	6,971·1	413·60
Neat Bellbird	J. C. Hodgson, Whakapara	1 348	240·5	365	7,315·6	406·21
Holly Oak Fantasia	T. A. Jennings, Mauriceville	1 263	240·5	365	5,939·4	388·50
Kitty of Rosy Creek	Jas. Nicolson, Kaupokonui	2 2	240·7	365	7,721·6	384·44
Roslyn Sweet Faith	A. J. Harris, Bombay	1 360	240·5	365	6,424·0	371·94
Bilberry's Flowerette	H. Naylor, Te Rapa	1 327	240·5	356	7,591·7	345·86
Noble Veronica	C. Parker, Hairini	2 52	245·7	294	6,466·4	342·22
Meadowvale Keepsake	W. Oxenham, Uruti	2 12	341·7	253	5,334·5	304·73
Spick of Dilkusha	H. Naylor, Te Rapa	1 286	240·5	311	5,200·9	299·16
Bilberry's Nellie	H. Naylor, Te Rapa	1 356	240·5	293	6,244·1	291·23
Bilberry's Doreen	H. Naylor, Te Rapa	1 342	240·5	344	5,168·6	284·23
Te Matai Win	H. Naylor, Te Rapa	1 284	240·5	248	5,022·3	263·58
Manor Farm Topsy	E. Harding, Woodville	2 29	243·4	357	4,562·2	259·33
Manor Farm Betsy	E. Harding, Woodville	2 50	245·5	311	5,029·5	253·07
Senior Two-year-old.						
Rewa Frieze	G. B. Hull, Wellington	2 301	270·6	365	9,753·9	518·51
Four-year-old.						
Woodstock Feerie	A. E. Watkin, Takanini	4 364	349·9	365	14,051·2	729·05
Silverdale Jenny	G. Hodgson, Whakapara	4 245	338·0	322	9,318·8	515·20
Silverstream Genoese	G. B. Hull, Wellington	4 3	313·8	365	8,057·0	493·71
Ohio Bilberry's Eminence	H. Naylor, Te Rapa	4 342	347·9	326	9,397·0	428·65
Raleigh's Success	A. E. Peppercorn, Cambridge	4 27	316·2	315	7,023·3	393·79

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
		JERSEYS—*continued.*				
Mature.		Yrs. dys.	lb.		lb.	lb.
Parakau Flower ..	W. T. Dazeley, Pukekohe ..	5 31	350·0	365	12,672·8	672·29
Orange Dale's Concord	W. J. Hall and Son, Matatoki	7 8	350·0	365	10,106·2	596·20
Richwood Molly ..	C. Parker, Hairini ..	8 24	350·0	364	10,228·6	587·54
Alfalfa Lassie ..	A. E. Watkin, Takanini ..	5 8	350·0	359	9,042·7	531·33
Sylvian Dale ..	J. K. Watson, Tatuanui ..	9 257	350·0	365	7,872·8	515·04
Silverdale Alma ..	G. Hodgson, Whakapara ..	5 361	350·0	365	9,404·9	503·70
Silver Dollar ..	G. S. Clarke, Te Awamutu ..	5 307	350·0	325	8,649·3	473·01
Canadian Zealandia ..	R. K. Garland, Matamata	5 118	350·0	365	7,230·8	424·29
		FRIESIANS.				
Junior Two-year-old.						
Brundee Maid† ..	W. S. Gallon, Dalefield ..	1 343	240·5	327	14,552·0	501·97
Ryvington Pontiac Segis Maid†	T. O. Hodgson, Tamahere (Estate)	1 219	240·5	353	9,363·1	347·65
Senior Three-year-old.						
Lebrina Clothilde Alcartra	Piri Land Co., Auckland ..	3 214	308·4	120	8,284·3	316·43
Mature.						
Milkmaid Korndyke†	Cameron Bros., Stratford ..	6 121	350·0	365	22,525·9	826·13
Cluny Pietje Transvaal†	W. S. Gallon, Dalefield ..	6 5	350·0	365	20,924·4	722·09
Coldstream Pontiac Wayne	O. A. Cadwallader, Greytown	7 53	350·0	182	14,044·1	504·94
Anawhata Colantha Johanna	P. F. Boucher, Kumeu ..	5 27	350·0	294	12,064·2	401·03
		MILKING SHORTHORNS.				
Junior Two-year-old.						
Riverdale Grace 7th†	T. W. Wardlaw, Waimana	1 327	240·5	365	10,491·2	424·92
Senior Four-year-old.						
Allandale Garnet† ..	R. S. Allan, Hatuma ..	4 318	345·3	365	15,891·1	550·80
Riverdale Grace 4th†	T. W. Wardlaw, Waimana ..	4 347	348·2	305	12,653·3	440·24
		RED POLLS.				
Two-year-old.						
Glen Eden Tablemaid	J. G. Donaldson, Stirling ..	2 62	246·7	310	6,416·4	264·47
Three-year-old.						
Waihou Pip ..	Wm. Jackson, Waihou ..	3 28	279·8	365	6,441·8	282·57
Mature.						
Glen Eden Annie ..	J. G. Donaldson, Stirling ..	6 37	350·0	365	11,480·9	437·90
Waikato Alpha ..	Wm. Jackson, Waihou ..	..	350·0	365	12,099·9	430·87
		Second-class Certificates.				
		Jerseys.				
Mature.						
Perfect Life ..	G. S. Clarke, Te Awamutu ..	5 355	350·0	357	9,274·7	553·48
		Red Polls.				
Four-year-old.						
Otahuna Red Rose ..	J. G. Donaldson, Stirling ..	4 89	322·4	365	8,833·7	347·07

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HORSE WITH STRINGHALT

K. T. M., Te Poi :—

I have a three-year-old unbroken gelding that has stringhalt. It was noticed after he had been driven over a dozen miles on a hot day. He did a good bit of galloping around, and became very hot. Do you think this was the cause of the stringhalt, or, as was suggested to me, could it have been caused by castration (performed over a year ago) ? Can anything be done for stringhalt ?

The Live-stock Division :—

The cause of stringhalt is obscure ; therefore it is impossible to say whether or not the galloping mentioned brought on the trouble, although it is quite likely that the excessive exertion hastened the symptoms, the actual cause of the disease being latent in the horse previous to the incident related. Castration is not considered to be a cause of stringhalt, as this ailment affects old horses more frequently than it does young animals. Regarding the treatment of stringhalt, operations of almost every conceivable nature have been tried on the leg in the hope of securing recovery, but the veterinary surgeon cannot be reasonably certain of effecting a cure in any case. In these circumstances we would advise you to turn your horse out for a spell of, say, three months, the animal having youth in his favour.

"FAIRY RINGS" IN LAWNS.

J. W. N., Gisborne :—

Can you advise me what treatment should be applied to "fairy rings" appearing in a tennis-lawn ? The number of rings has increased since last year, when only one or two were noticed.

The Horticulture Division :—

To destroy "fairy rings" the ground should be thoroughly soaked with sulphate of iron in the proportion of 1 lb. to 1½ gallons of water. This treatment should be repeated twice at intervals of a fortnight, with the solution at half the previous strength. The fungus never grows twice in the same place ; it spreads outward all the time. Therefore the soil chiefly to be treated is a ring beyond where the fungus is now growing, and where so far no fungus has been seen. Where the fungus has previously grown it leaves a mat of mycelium in the soil. This for a time renders the soil almost impervious to water, and the grass is starved and dies out. After a time the mycelium dies, the soil is left enriched with nitrogen, and, permeability being again restored, the grass grows stronger than before infection. The sulphate-of-iron treatment will disfigure the grass, but it soon recovers.

FOOT TROUBLE IN DAIRY COWS.

F. W. G., Kihikihi :—

Will you please advise me on the following matter : Several of my dairy cows, notably those which milk fairly heavily and are of mature age, have developed a tenderness in their feet, more especially the hind feet. The hoof in each case is cracked and ragged-looking, too long in the toe, and inclined to flatness instead of the usual slope from the coronet. The farm is mainly high land, in no way waterlogged in winter, and the ground not hard or baked even in dry weather. The pasture is well top-dressed, mainly with superphosphate, and the stock have the usual rock-salt lick. Lately I have given the dairy cows access to boxes containing bonemeal and coarse salt.

The Live-stock Division :—

In many instances, unless the feet of dairy cows are kept regularly dressed and trimmed, especially the hind feet, they will grow long at the toe and begin

to crack. The weight of the animal with long feet is thrown back on the heels; therefore tenderness and lameness will result. A good instrument to use for cutting the feet is a blacksmith's hoof-cutters. The instrument resembles the pincers used by blacksmiths, but has one edge thick and blunt. After using this the hoof rasp may be used to trim and round off the horn. A tenon saw may also be used, but this is awkward to handle and not so satisfactory. The growth and quality of the horn are also influenced by the general health of the animal. Whether this is caused by a deficiency, malnutrition, or any other disease (for instance, digestive disorders), steps to rectify should be taken, and the regular trimming of the feet is of great importance. The nature of the ground the animals have to walk on is also a fruitful source of trouble.

DETAILS OF WALK-THROUGH MILKING-SHED.

"AUSSIE," Hastings :—

I intend to build new cow-bails on the walk-through plan. In the Department's Bulletin No. 87 the width of bail is given at 2 ft. 3 in. As I cover my cows in the winter (I milk all the year around) the width mentioned seems too fine for removing and replacing the covers, and I should like an opinion whether 3 ft. would be too wide and allow the cows too much room.

The Dairy Division :—

We may say that 2 ft. 3 in. is the usual width allowed for cow-bails in walk-through sheds. The bulge of the cow is beyond the end of the dummy barrier, and the space available should be ample for rugging. If your cows are exceptionally large a width of 2 ft. 6 in. would probably be enough. In connection with the general plan given in the bulletin we may add that some prefer the width of the slab of concrete outside the end of the shed to be 2 ft. 6 in. instead of 5 ft., as cows are less likely to turn round on the narrower space; also that the doors open all one way. The posts of the fence round the yard are best placed on the outside.

INCIDENCE OF TWIN LAMBS.

"SUBSCRIBER," Pleasant Point :—

Would you please tell me the reason why so many more twin lambs arrive at the beginning of the lambing season than later on? If one kept more rams, and changed them at intervals, would the ewes be likely to have more twin lambs?

The Live-stock Division :—

The greatest factor which influences the incidence of twin lambs is the condition of the breeding-stock at the time of mating. Ewes which have been "flushed" before mating always give a greater percentage of lambs (provided the rams are in breeding-condition) than ewes unflushed. The fact that a greater percentage of twins are born at the commencement of the season points to this as being the reason. Some of the single-lamb ewes may even be fortunate in having a lamb at all, owing to having been in an unflushed condition. You may be confident that twinning is not due to the ram, for if he is capable of impregnating the ewe that is all that is required; the rest depends on the ewe.

ANT-NESTS ON BOWLING-GREEN.

W. NYE, Foxton :—

Could you inform me the best way to eradicate ants on a bowling-green? Here the ants are simply spoiling the green, leaving holes where they have their nests. Any information in regard to checking the pest will be appreciated.

The Horticulture Division :—

The simplest way of destroying the ant-nests in your bowling-green would be to pour a small quantity of carbon bisulphide into the holes and cover them with a little soil to retain the gas evolved. The material is very volatile and inflammable, so that suitable precautions should be taken.

WINTER LICK FOR LAMBS.

J. D., Okoia :—

I should be glad of a recipe for making a lick for lambs. We have some difficulty in carrying a big mob through the winter, and it appears to me that there is something lacking in the soil which the lambs require. I have plenty of rock salt at their disposal.

The Live-stock Division :—

We take it that you exclude the possibility of internal parasitic infestation when you refer to difficulty in carrying the lambs through the winter. Over-stocking and badly drained pastures are two of the main factors in the spread of parasitic trouble. A lick containing the following ingredients is recommended : Common salt, 40 parts ; phosphate of calcium, 20 parts ; bicarbonate of potash, 10 parts ; sulphate of iron, 3 parts. This will supply any deficiency of salts in the pasture, but by itself is not sufficient if parasites are at the bottom of the trouble.

WEATHER RECORDS : FEBRUARY, 1928.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows : —

GENERAL NOTES.

THE month began with the Dominion in the throes of one of the driest spells experienced for many years, but after the first week the prospects of rain began to improve gradually, each successive pressure disturbance causing more wide-spread rain than its predecessors. On the 21st conditions became definitely favourable, and rains, though still far from general and in most cases only light, fell over large parts of both Islands. The type of weather changed completely thenceforward. General rains fell on the 23rd–24th and the 26th–27th. From the 24th there was a considerable drop in temperature. Snow fell on many of the mountain areas, especially in the South Island, during the 26th 27th. As far as monthly totals are concerned, the rain of the latter end caused February to lose much of its droughty character. Though the first three weeks were almost everywhere very dry, moderate to heavy falls were experienced generally during the last week, and scattered places, especially in the North Island, received more than the average. The deficiencies were most serious in the Taranaki and Nelson Provinces and in parts of Manawatu. On the west coast of the South Island from Greymouth southwards most places appear to have had more than the normal February fall.

As regards pressure, the most prominent feature of the first ten days was one which the month had inherited from January— namely, the persistence of high pressure over the northern portions of the North Island. Two tropical cyclones were experienced in the Pacific islands to the north-east towards the end of January. Subsequent to their passage the pressure rose in that region, and one of the conditions adverse to rain in New Zealand appeared to have been removed. Low barometers were, however, still the rule over Australia, where very heavy rains occurred. It was not until after anticyclonic conditions had been fully established, on the 23rd, in Australia that the wet period commenced in New Zealand, the low pressure area now shifting to the Dominion.

The rapid movement of pressure systems which has been commented on in these notes for months past was no less pronounced during February. A depression would cross the South Island within about thirty-six hours of passing Hobart. Such depressions as affected the Dominion were mainly shallow waves. Those recorded reached us on the 2nd, 5th, 9th, 10th, 13th, 17th, 18th, 21st, 23rd, 25th, and 28th, the number being unusually large for a single month. That of the 21st was the only one which was deep on its arrival over New Zealand, but pressure was low over and to the east of the North Island from the 25th to the 28th.

Anticyclones were, as a rule, rather poorly developed during the month. Centres passed on the 4th, 8th, 12th, 15th, 22nd, and 24th. Of these, that of the 15th was the most intense, the pressure reaching 30·5 in. in some places. It has been noticed that the break of a drought, as happened on this occasion, is frequently preceded by the development of an intense anticyclone.

Winds were light on the whole, but strong southerlies prevailed, more especially from Cook Strait northwards, on the 27th and 28th. Gales were reported from many parts of the North Island.

Temperatures were generally above normal. In parts of the North Island a frost occurred on the morning of the 29th in the clear weather following the cold southerly winds.

RAINFALL FOR FEBRUARY, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	2·28	5	1·52	2·95
2	Russell	1·52	6	0·96	3·20
3	Whangarei	3·18	6	2·90	4·46
4	Auckland	1·61	5	0·79	3·06
5	Hamilton	4·30	7	2·12	2·96
6	Kawhia	3·74	7	1·62	2·66
7	New Plymouth	1·42	6	0·63	4·00
8	Riversdale, Inglewood ..	3·37	6	1·52	6·30
9	Whangamomona	2·05	5	1·07	4·23
10	Eltham	2·23	6	0·86	3·37
11	Tairua	7·36	4	4·16	4·10
12	Tauranga	3·21	18	1·97	3·58
13	Maraehako Station, Opotiki	2·64	6	1·44	3·48
14	Gisborne	2·38	11	1·40	3·63
15	Taupo	1·98	5	0·70	2·82
16	Napier	3·10	9	1·31	2·92
17	Maraekakaho Stn., Hastings	1·89	9	0·64	2·52
18	Taihape	2·54	7	1·03	2·52
19	Masterton	2·05	8	0·84	2·70
20	Patea	3·86	7	1·31	2·51
21	Wanganui	2·93	6	0·95	2·52
22	Foxton	1·02	4	0·44	2·06
23	Wellington	3·58	7	1·58	3·07
	South Island.				
24	Westport	1·95	11	0·40	4·37
25	Greymouth	5·99	13	1·34	5·99
26	Hokitika	7·18	11	3·09	7·31
27	Ross	11·06	9	5·73	8·45
28	Arthur's Pass	6·64	10	1·25	10·17
29	Okuru, Westland	6·82	7	1·32	7·92
30	Collingwood	1·37	6	0·58	5·63
31	Nelson	1·56	5	0·92	2·77
32	Spring Creek, Blenheim ..	1·73	4	1·20	2·25
33	Tophouse	2·72	9	0·45	4·39
34	Hanmer Springs	3·61	12	0·94	3·04
35	Highfield, Waiau	2·96	9	1·00	2·54
36	Gore Bay	4·19	11	1·52	2·93
37	Christchurch	0·94	7	0·37	1·77
38	Timaru	1·06	11	0·30	1·82
39	Lambrook Station, Fairlie ..	1·52	7	0·44	1·89
40	Benmore Station, Clearburn	1·05	5	0·51	1·36
41	Oamaru	1·35	5	0·52	1·68
42	Queenstown	1·87	8	1·11	1·98
43	Clyde	1·48	6	0·74	0·99
44	Dunedin	2·59	9	1·31	2·69
45	Wendon	2·58	7	1·00	2·03
46	Gore	2·08	11	0·78	2·65
47	Invercargill	1·85	16	0·47	2·85
48	Puysegur Point	7·54	16	1·31	4·96
49	Half-moon Bay, Stewart Is.	1·79	10	0·63	4·13

EXPORT OF PUREBRED DAIRY CATTLE IN 1927.

DURING the calendar year 1927 New Zealand exported forty-three head of purebred dairy cattle. The majority of these went to Australia and Tasmania, while a small consignment was shipped to South Africa, and one Jersey bull to Noumea. Only two breeds—Jersey and Friesian—were represented in the year's exports. The total declared value of the forty-three head was £2,232 15s., or an average value per head of £51 18s. 6d. For purposes of comparison it may be stated that the 1926 figures were forty-one head, with a total declared value of £3,521, or about £86 per head. The exports for 1927 thus show a considerable decrease in average value. The decrease is largely accounted for by the fact that in 1926 many specially selected and outstanding individuals were included in the exportations, whereas last year's shipments were comprised mainly of animals of more average quality.—*Dairy Division.*

IMPORTATION OF CATTLE FROM UNITED STATES OF AMERICA.

The following regulations under the Stock Act were gazetted on 16th February, 1928, and came into force on that date:—

1. Subject to the provisions of the principal regulations (gazetted 4th October, 1915), and to the following conditions, cattle may be introduced into New Zealand from the United States of America.
2. Every person desiring to introduce cattle as aforesaid must first obtain a permit to do so from the Minister of Agriculture.
3. Such cattle on arrival in New Zealand shall undergo quarantine at a quarantine ground for sixty days, and after liberation from the quarantine ground shall be subject to quarantine surveillance for such time as the Director may direct.
4. Every shipment of cattle must be accompanied by a statutory declaration, in the form No. 1 of the Schedule, made by the shipper of such cattle, setting forth the kind, number, sex, and brands or marks of such cattle, and declaring that all such cattle have been bred or domiciled throughout in a State where Texas fever does not exist, and never has existed; that they are at the time of shipment, and have been during the preceding six months, free from all infectious and contagious diseases; that they have not during the six months immediately preceding shipment been in direct or indirect contact with any stock infected with any such disease, and that the regulations of the United States Department of Agriculture (Bureau of Animal Industry) governing the inter-State movement of animals have been duly complied with.
5. On every such declaration there shall be inscribed a certificate, in the form No. 2 of the Schedule, signed by a Veterinary Officer of the Bureau of Animal Industry, certifying that he has, within the fourteen days immediately preceding the date of shipment to New Zealand, examined and tested with the tuberculin test such cattle and has found them free from infectious and contagious diseases. Particulars with respect to such test, showing dosages and temperature records shall be supplied with such certificate.

The schedules may be seen in the *Gazette.*

Improvement in Meat-product Processes.—Recent local work in this field was referred to by the Acting-Chairman of the Council of Scientific and Industrial Research, at its February meeting, as follows: "As the result of investigations, new processes have been elaborated whereby certain products of meat-works which, on account of excessive salinity, were useless can now be saved and utilized for the manufacture of pig and poultry feeds. The new process, which involves the use of sodium nitrate, makes possible very considerable saving in time, the preparation of a standardized product, and eliminates the waste which hitherto prevailed. Details of the dry-rendering-of-meat process have also been elaborated, and this may make a considerable advance in the meat industry. At present the question of an alternative preservative process to replace the boric preservative hitherto used in bacon-curing is receiving attention."

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CERTIFICATION OF SEED WHEAT.

INAUGURATION OF SYSTEM IN CANTERBURY.

J. W. HADFIELD, H.D.A., Agronomist, Department of Agriculture, Christchurch.

A SYSTEM of certification of seed wheat was inaugurated this season in Canterbury by the Fields Division of the Department of Agriculture, in co-operation with the Department of Scientific and Industrial Research, through the recently formed Wheat Research Committee. The salient features of the scheme are here outlined, and an account is given of the first season's operations.

The object of certification is to render available to merchants and growers lines of seed reasonably pure and free from disease. It is hoped to stimulate the production of such seed by offering the grower a bonus, and its distribution by establishing the fact that its use will render yields more stable, the produce more readily saleable, and bring about marked improvement in the general standard of milling-wheat grown in New Zealand.

It has been proved that the majority of the diseases which each year take serious toll of our wheat crops are seed-borne. Some, in addition to being seed-borne, are carried over from year to year in the soil; but this does not alter the fact that the seed is the most important agency in the distribution of disease, and the loss thus entailed can be almost entirely eliminated by the use of disease-free seed. It is quite within the bounds of possibility for the mycologist and plant-breeder to produce seed which is at least free from the more serious diseases, and certification following its distribution is the logical extension. In the meantime certification merely indicates those crops relatively free from disease, and affords the most practical means of reducing to within reasonable limits the loss which is a very real burden to the grower.

The general standard of purity of our wheats, more particularly as regards the Velvet variety, is far from satisfactory. This aspect of the question is of serious importance to millers, and, in addition, the cause of some loss to growers.

CROP AND GRAIN INSPECTIONS.

It was decided for this, the first season, to limit inspections to crops grown by the Canterbury Agricultural College, Lincoln, and to crops

grown by farmers from seed produced by the College the previous year. It was therefore obviously necessary to draw a distinction between the seed produced by a recognized institution or individual engaged in the production of pure lines and that produced by a grower who is not the originator of the line he is growing. In sealing the sacks the former is given a distinctive red tag and is termed "pedigree certified seed," while the latter is termed "farmers' certified seed," and the certification tag is white. Growers of Lincoln College 1926–27 seed were accordingly circularized and invited to tender their crops for certification if they so desired.

Inspection of the seed is not a reliable means of determining whether diseases are present; moreover, it is extremely difficult to identify impurities and the proportion of such impurities by an examination of the grain. For this reason it becomes imperative to make a careful inspection of each growing crop, and such field inspections become a very necessary and important feature of all certification work.

Growers of crops which passed the necessary field inspection were requested to sign a guarantee to have the threshing-mill thoroughly cleaned down; and in addition to this precaution the first three, and sometimes the last three, sacks from the mill were rejected. The grain was sampled immediately after threshing by an officer of the Department of Agriculture, the sample was graded, and the line accepted or rejected accordingly On acceptance, the grain was machine-dressed under supervision, and the bags sealed and tagged. The certification tag indicates the name of the variety, the grower, and the merchant dressing the seed.

It was decided to limit certification during the 1927–28 season to Solid-straw Tuscan, Hunter's, and Velvet. Unfortunately, no Velvet crops passed the necessary standard.

PURCHASE OF WHEAT.

The wheat was purchased by the Department of Agriculture in quantities sufficient to fill orders already on hand from merchants. It was purchased at a uniform price — namely, that price for milling-quality of each variety ruling on 31st March, plus a bonus of 6d. per bushel.

Growers evinced a disinclination to sell under these terms, which explains the reason for so few crops offering. That the date stated often coincides with a period of fall in the market had not been overlooked, but there appeared to be no alternative, and the 6d.-per-bushel bonus appeared more than sufficient to cover any fall in price likely to occur. Disregarding the forward buying, which commenced about December at round about 6s. per bushel for Tuscan, much of the wheat purchased by the Department could have been sold possibly at 5s. 8d. or 5s. 9d. Actually the price fixed on 31st March was as follows:—

Tuscan, 5s. 8d. plus 6d. bonus = 6s. 2d. per bushel.
Hunter's, 6s. plus 6d. bonus = 6s. 6d. per bushel.
Velvet, 6s. 6d. plus 6d. bonus = 7s. per bushel.

Growers are paid as soon as possible after 31st March—that is, as soon as the merchants have received and paid for the seed wheat received by them.

MACHINE DRESSING.

Merchants agreed that one firm and no more in each centre should undertake the dressing of any one variety, and in doing so showed a fine spirit of co-operation, for obviously firms would as a rule desire to attend to the dressing of their own seed. This arrangement enabled each variety to be sold at a uniform price in any one centre, by pooling the dressing-costs, railage, &c., of all lines of each variety. Moreover, it allowed of more even distribution of the lines from different sources.

ESTIMATION OF EX-STORE PRICE.

This price is arrived at for each variety in each centre by the firm dressing that particular variety. The following is an actual example of such a return obtained from one line of wheat. It must be remembered that all lines are averaged to obtain the selling-price of any one variety.

	£	s.	d.
Into machine—			
251 sacks ($840\frac{37}{60}$ bushels) Tuscan, at 5s. 8d.	238	2	6
Bonus to grower, at 6d. per bushel	21	0	2
Railage	6	13	3
Receiving, at 2s. 3d. per 10 sacks	2	16	5½
Delivery ex store, at 2s. 3d. per 10 sacks	2	16	5½
Cleaning, at 4d. per bushel	14	0	2
Haulage on 314 bushels, at 1d. per bushel	1	6	2
	286	15	2
Less offals, 22⅓ bushels, at 4s. 3d. per bushel	4	14	11
	282	0	3

Ex machine—

$814\frac{48}{60}$ bushels cost £282 0s. 3d. = 6s. 11d. per bushel.

[NOTE.—In the above return no allowance has been made for the following items, because they were not actually expended in this instance: Sampling, at 9d. for 10 sacks; branding, at 4s. 6d. per 100 sacks; storage, 3d. per 10 sacks per week; insurance, 1s. 6d. per cent. per month.]

FIXING OF SELLING-PRICE.

It will be seen that it is possible to fix the selling-price from the ex-store price by adding the merchant's commission. The following scale agreed to allows for storage, interest, and other charges in the example just quoted:—

Ex-store price, 6s. 11d. per bushel.
Plus merchants' commission, 6d. per bushel.
Price for April—Cash 7s. 5d., booked 7s. 7d., per bushel.
Price for May—Cash 7s. 5½d., booked 7s. 7½d., per bushel.
Price for June—Cash 7s. 6d., booked 7s. 8d., per bushel.
Price for July—Cash 7s. 6½d., booked 7s. 8½d., per bushel.

RESPONSE BY MERCHANTS AND WHEATGROWERS.

Decision regarding the inauguration of certification was arrived at during December last, and organization was necessarily hurried. Neither merchants nor growers really had sufficient opportunity for discussing the scheme, but the response by merchants was most encouraging. The North Canterbury Grain and Produce Merchants' Association backed the scheme whole-heartedly, and rendered most valuable advice and assistance. Growers responded very tardily, and their justification for this attitude has already been explained.

The following areas were inspected :—

	Inspected. Acres.	Passed Field Inspection. Acres.
Solid-straw Tuscan	97	97
Hunter's	250	118
Velvet	126	Nil.

A few growers withdrew their crops, and the following actually sold grain which was certified and sealed :—

A. E. Tutton, Broadfields	Solid-straw Tuscan.
D. Jones, Dunsandel	,,
J. F. Dawson, Fernside	,,
T. H. Wilkinson, Spotswood	Hunter's.
Geo. McCullough, Temuka	,,
E. W. Milne, Greenpark	,,

Merchants came forward with orders for 2,300 bushels of Solid-straw Tuscan, 1,940 bushels Hunter's, and 836 bushels Velvet. It was obvious that orders would have to be filled *pro rata*, and a number which arrived late had to be refused. These are not included in the above.

Exclusive of Lincoln College, which has produced all the pedigree certified wheat this season, the following firms have purchased and been supplied with farmers' certified seed wheat :—

Dalgety and Co., Ltd., Christchurch.
New Zealand Farmers' Co-operative Association, Ltd., Christchurch.
Wright, Stephenson, and Co., Ltd., Christchurch.
Canterbury Seed Co. (N.Z.), Ltd., Christchurch.
National Mortgage and Agency Co., Ltd., Christchurch.
Wood Bros., Ltd., Christchurch.
Matson and Co., Christchurch.
Darling and McDowell, Oamaru.
Wright, Stephenson, and Co., Ltd., Oamaru.
New Zealand Farmers' Co-operative Association, Ltd., Leeston.
Grain and Produce Merchants' Association, Blenheim.

GENERAL.

Mr. H. B. Veitch, Government Grain Grader, was appointed to supervise the grading, purchase, and distribution of the wheat, and it is very largely due to his expert knowledge and capable management that the scheme has been brought to a successful issue.

A somewhat full account of the scheme has been presented—fuller perhaps than is justified by the amount of wheat handled this past season. It is confidently anticipated, however, that the system will extend, and the present opportunity has been taken of bringing the details to the notice of those who are interested and securing wider publicity in general.

MIXING FERTILIZERS: "POTASH SALTS."

THE fact that certain potash fertilizers are sold under the name of "30 per cent. (or 20 per cent.) potash salts" has apparently led to uncertainty in the minds of some readers making use of the fertilizer-mixing chart published in the *Journal* for September, 1926, and in Bulletin 129. It should be clearly understood that the term "potash salts" appearing in the chart refers to all potash compounds, including kainit and sulphate and muriate of potash.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1927.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE summary of results under the C.O.R. system for the calendar year 1927 shows that 529 certificates were issued during the twelvemonth. In comparison with the preceding year this represents a decrease of forty-seven certificates. It is noticed, however, that in the majority of classes the average production has increased, which fact admits of two interpretations—either the quality of our purebred dairy stock is improving, or breeders are more carefully selecting their test teams. Probably there is something to be said on either side. A review of the production of C.O.R. cows since the commencement of the system indicates that much progress in average yield has been made, but of later years conditions have led to curtailed and more carefully chosen C.O.R. entries.

THE OFFICIAL HERD-TEST AND C.O.R.

The Official Herd - test, introduced last spring, is meeting with encouraging support. This test is open to all breeders entering cows for certificate-of-record test, and all registered purebred dairy cows are eligible. The system is also open to cows other than purebreds in those districts where no other means of having the cows tested (Group, Association, &c.) is conveniently available. Particulars of the " O.H.T." were published in the *Journal* for July, 1927, but for the benefit of those who are not informed as to the system it may be briefly outlined as follows : The Official Herd-test is carried out by C.O.R. testing officers at the time of their usual monthly visits. The testing officer takes a note of the milk-yield of O.H.T. cows for the same period as for C.O.R. cows. He also takes samples for two milkings. The owner takes no milk-weights, and from the testing officer's figures for milk yield and test the returns for the month are figured in the head office of the Dairy Division. The O.H.T. is for a maximum period of 305 days—that is, a ten-months test—as compared with the full-year test under the C.O.R. system.

During the height of the present season there were 214 breeders testing 605 cows under the C.O.R. system. Of these, 111 breeders were testing 1,506 cows under the O.H.T. system. This must be regarded as gratifying support, and it is also pleasing to find that, although the O.H.T. was looked upon as more or less an experiment, no criticism of any importance has so far been levelled against it. Further, although the first year's rules may require a little extension, it is not anticipated that they will need more than minor amendment. It may also be mentioned that the number of C.O.R. cows per breeder has not decreased as the result of the introduction of the Official Herd-test. A complete survey of the O.H.T. system in 1927-28 will be published in the *Journal* at the termination of the season.

CERTIFICATES ISSUED.

Since the commencement of the C.O.R. system 5,777 cows have been granted first-class certificates. During the year 1927, certificates were issued on first performance for 449 cows, and on second or subsequent performance for 80 cows, making a total of 529 certificates. Details are given in the following table, figures for the preceding year being also given for purposes of comparison :—

Table 1.

Breed.	1927.			1926.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	333	50	383	371	57	428
Friesian	65	24	89	94	16	110
Milking Shorthorn ..	25	3	28	9	3	12
Ayrshire	16	1	17	15	1	16
Red Poll	10	2	12	8	2	10
Totals ..	449	80	529*	497	79	576

* Representing 528 cows, one cow having qualified for two certificates within the year.

Second-class Certificates.—Only twenty-two second-class certificates were issued in 1927. These went to twelve Jerseys, nine Friesians, and one Red Poll. These numbers are obviously too small to permit of division into classes, but, grouping the cows of each particular breed into one class, the twelve Jersey records average 523·91 lb. butterfat, and the nine Friesians 523·32 lb., while the one Red Poll yielded 347·07 lb.

Readers will recall that the rules governing C.O R. testing provide that for first - class certificates the period between calving for commencement of test and calving subsequent to test shall not exceed 455 days (fifteen months). For second-class certificates an extension to 485 days (sixteen months) is permitted. The average period between calving for test and calving subsequent to test for all cows which gained first-class certificates in 1927 was 393 days For second-class C.O.R. the period was 468 days. This compares with 391 days and 470 days respectively for the preceding twelve months.

JERSEYS.

Class-leaders.

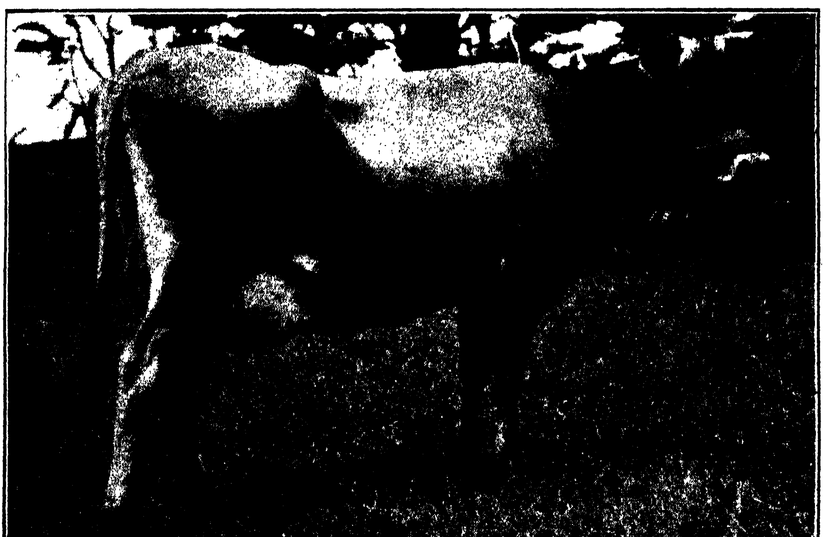
The list of Jersey class - leaders shows two changes for the year under review. These occurred in the junior two-year-old and the four-year-old classes. In the former class Mr. G. E. Yelchich's Keston Flower, 694·28 lb. butterfat, gives way to Ivondale Oxford Lass, which gained a certificate for 731·29 lb. Ivondale Oxford Lass was owned during her testing-period by Mr. R. S. Tuck, of Waharoa, although she was bred by Mr. P. J. Peterson, of Brixton, Taranaki. In the four-year-olds Mr. A. J. Smith's St. Lambert's Bell, 780·32 lb. butterfat, is replaced by Mr. G. E. Yelchich's Keston Flower, which raises the highest performance of this class to 814·95 lb. Thus Keston Flower,

although defeated in one class, still holds a place in the list of class-leaders. She was bred by Mr. C. B. Herrold, of Waiuku, while her certificates were gained under the ownership of Mr. G. E. Yelchich, of the same centre.

The Jersey class-leaders are now as follows :—

Table 2.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Ivondale Oxford Lass	R. S. Tuck, Waharoa..	1 338	240·5	365	12,107·7	731·29
Senior Two-year-old.						
Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old.						
Ivondale Golden Lass	P. J. Petersen, Waitara	3 312	308·2	365	14,434·8	905·01
Four-year-old.						
Keston Flower ..	G. E. Yelchich, Waiuku	4 64	319·9	365	14,679·2	814·95
Mature.						
Holly Oak's Annie..	W. T. Williams, Pukehou (deceased)	5 9	350·0	365	18,522·7	1,056·49



KESTON FLOWER (G. E. YELCHICH, WAIUKU).

Leader of the Jersey four-year-old class.

[*Dairyfarmer photo.*

Jersey Class-averages.

Three of the Jersey classes show an increase in average production for 1927 as compared with 1926, while in the two remaining classes there is a slight decrease. Taken as a whole the average Jersey for 1927, with 469·36 lb. butterfat, produced 7·68 lb. butterfat more than the average Jersey for the preceding year. A total of 383 cows is represented for 1927, and, as is usual, the largest classes are the junior two-year-old and the mature; in fact, the junior two-year-olds, 167 in number, represent 43½ per cent. of the Jerseys certificated during the year. The length of average lactation—349 days—is three days in excess of that for the preceding year.

The class averages for 1927 and 1926 are given in the following table:—

Table 3.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1927.		lb.	lb.
Junior two-year-old ..	167	348	7,280·2	416·07
Senior two-year-old ..	43	348	7,950·9	453·54
Three-year-old	56	348	8,962·3	498·69
Four-year-old	39	354	9,394·0	520·35
Mature	78	353	9,669·9	545·63
	1926.			
Junior two-year-old ..	180	347	7,128·7	399·62
Senior two-year-old ..	51	340	8,059·6	455·22
Three-year-old	61	345	8,784·8	491·43
Four-year-old	33	347	9,405·9	527·11
Mature	97	350	9,794·1	543·13

The averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system in 1912 are given in the following table:—

Table 4.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	1,737	345	6,952·9	388·70
Senior two-year-old ..	487	344	7,693·4	432·69
Three-year-old	692	342	8,351·8	464·43
Four-year-old	427	345	8,821·3	489·81
Mature	1,130	345	9,303·2	509·80
All	4,473	344	8,022·1	445·45

Jersey C.O.R. Bulls.

For the benefit of readers who are not conversant with the details of the C.O.R. system, it may be repeated that a bull is entitled to be called a certificate-of-record bull when he has sired four certificate-of-record daughters, each daughter being from a different dam. In addition, the Jersey Breeders' Association recognizes a special class for what it terms champion butterfat bulls. The qualifications for a champion butterfat bull require that the animal must have at least five C.O.R. daughters from different dams, each daughter having doubled its minimum butterfat requirement for a certificate. Some 266 Jersey bulls have now qualified for the C.O.R. list, while twelve of these are eligible for inclusion in the champion class. In the following list champion butterfat bulls are marked †. The list includes those C.O.R. bulls which have added to their number of C.O.R. daughters during the year, or have during that period newly qualified for the class.

Table 5.

Key to numbers opposite names: First number—first-class C.O.R. daughters; second number—ditto, qualified on subsequent performances; third number—second-class C.O.R. daughters; fourth number—total of preceding numbers. Bulls marked * qualified for C.O.R. list in 1927.

Grannie's Knight†	51	11	3	65
Sultan's Disdain	44	11	5	60
Noble Twylish	30	4	0	34
Viola's Golden Laddie†	24	6	1	31
V.C.†	21	3	0	24
Waipiko Masterpiece†	18	6	1	25
Proud Fox	19	8	1	28
Holly Bank Squire†	18	3	2	23
Meadowvale Conqueror	18	3	0	21
Sunflower's Perseus†	16	4	0	20
Bilberry's Twylish†	15	1	2	18
Hawkesbury Emperor	14	6	0	20
Owler of Puketapu†	14	0	3	17
Admiral	14	2	0	16
Bridge View's Magnet	14	1	0	15
Rainbow's King†	13	3	1	17
Brampton Merry Boy	13	0	0	13
Maid's General	12	2	1	15
Aster's Golden Lad	11	2	1	14
Eileen's Fox	11	2	0	13
Fox's Double	11	0	0	11
Woodstock Golden Lad	10	2	1	13
Belvedere Jersey Boy	10	2	1	13
Distinction's Twylish	10	0	1	11
Belvedere Silver Trumpeter	10	0	0	10
Beechland's White Swan	9	1	0	10
Waipiko Leonard	9	0	0	9
Marshlands Masterpiece	9	0	0	9
Majesty's Eminent	9	0	0	9
Sunglow	8	2	1	11
Brentwood Gallant	8	2	0	10
Ivondale's Rainbow	8	2	0	10
Sherry's Fox of Collingwood	8	1	1	10
Cambridge Rata King	8	1	0	9
Golden Reef	7	2	0	9
Miro Meadows Dick	7	2	0	9
Belvedere Sun King	7	1	0	8
Molly's Lad	7	0	1	8
Bessie's Twylish	7	1	0	8
Bright Sultan	7	0	0	7
Mountain View's Rioter	7	0	0	7
Ngahiwi Silent Knight*	7	0	0	7
Willowbrook Lord	7	0	0	7
Tiki's Twylish	6	3	1	10
Miro Meadows Paddy	6	2	0	8
Brentwood Hero	6	0	0	6
Briar's Twylish	5	1	1	7
Roto*	5	1	0	6
Caius	5	0	0	5
St. Aubins Golden Lad	5	0	0	5
Viola's Noble of Glenmore*	5	0	0	5
Fernaig Exile*	5	0	0	5
Marshall Aldan*	5	0	0	5
Miro Meadows Tim*	4	0	2	6
Clarion*	4	0	1	5
Miro Meadows Boss*	4	1	0	5
Reid Park's Teasel*	4	0	1	5
Woodland's Black Boy*	4	1	0	5
Dominion Golden Cygnet*	4	0	0	4
Miro Meadows Pay Day*	4	0	0	4
Rajah of Bulls*	4	0	0	4
Waipiko Lionello*	4	0	0	4
Whenuku Canadian Noble*	4	0	0	4
Reid Park King of Sunbeams*	4	0	0	4
Idalia's Royalty*	4	0	0	4
Miro Meadows Buttermaker*	4	0	0	4
Matchless Raleigh*	4	0	0	4

FRIESIANS.

Class-leaders.

While 1927 added several meritorious performances to the steadily increasing list of our C.O.R. Friesians, the class-leaders for the breed remain as they stood four years ago. Except in the three-year-olds, however, the Friesian class-leadership yields are higher than for any of the other breeds tested under the C.O.R. system; moreover, it is not likely that any of the present Friesian leaders will be seriously challenged during the season now in progress. The list of class-leaders is here repeated.

Table 6.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old. Netherland Princess 4th	John Donald, Westmere	2 341	274·6	365	19,621·6	805·77
Junior Three-year-old. Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old. Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·9	863·51
Junior Four-year-old. Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old. Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910·74
Mature. Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145·24

Friesian Class-averages.

The average C.O.R. Friesian for 1927 produced 502·09 lb. of butter-fat, compared with 483·10 lb. for the preceding year, an increase of 18·99 lb. Of the seven classes into which the breed is subdivided four have shown increases, while the remaining three have failed to maintain the production of the previous twelve months. In all, 89 Friesians were certificated in 1927, a falling-off of 21 from 1926. The class-averages for 1927 and 1926 are given in the following table:—

Table 7.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1927.		lb.	lb.
Junior two-year-old ..	32	346	12,250·0	432·18
Senior two-year-old ..	13	336	12,615·3	455·66
Junior three-year-old ..	7	345	14,681·3	502·82
Senior three-year-old ..	3	161	7,853·8	315·89
Junior four-year-old ..	4	359	17,275·4	610·31
Senior four-year-old ..	5	331	13,968·6	489·10
Mature	25	341	17,449·6	623·13
	1926.			
Junior two-year-old ..	43	331	11,479·7	405·80
Senior two-year-old ..	11	356	14,086·2	492·10
Junior three-year-old ..	9	357	12,727·7	458·16
Senior three-year-old ..	8	331	14,114·1	541·22
Junior four-year-old ..	7	348	17,144·2	598·87
Senior four-year-old ..	4	348	17,062·3	562·36
Mature	28	348	15,723·4	549·41

The following table shows the averages, class by class, of all certificates issued to Friesian cows since the commencement of the C.O.R system in 1912 :—

Table 8.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	448	345	11,305·1	401·24
Senior two-year-old ..	203	346	12,263·0	434·66
Junior three-year-old ..	153	341	13,145·3	461·69
Senior three-year-old ..	146	334	13,520·4	482·57
Junior four-year-old ..	96	342	14,713·1	518·88
Senior four-year-old ..	91	346	15,565·6	539·15
Mature	441	339	15,507·7	542·76
All	1,578	342	13,439·2	473·58

Friesian C.O.R. Bulls.

Ninety-two Friesian bulls have now qualified for the C.O.R. class, and of these thirteen are eligible for inclusion in the present summary —that is, thirteen Friesian bulls have added to their number of C.O.R. daughters during the year, or have during that period newly qualified for the class. Four new names were added during the year. The list is given in Table 9 which follows.

Table 9.

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1927.

Woodcrest Hengerveld Mechthilde	19	4	3	26
Rosevale Korndyke Sylvia Posch ..	17	14	2	33
Rosevale King Sylvia ..	14	3	3	20
Ensign Pontiac Valdessa Fayne	12	2	1	15
Woodcrest Pontiac Alcartra	9	2	1	12
Dominion Woodcrest Beets	9	0	0	9
Echo Sylvia Sir Griselda*	8	0	2	10
Rosevale Plus Triumph	7	3	0	10
King Pontiac Valdessa	7	2	0	9
Dominion Paul Colantha	7	0	0	7
Rosevale Inka Sylvia Model*	5	0	0	5
King Alcartra Pietje* ..	4	2	0	6
Pareora Cadillac Hero* ..	4	1	0	5

MILKING SHORTHORNS.

Class-leaders.

With the exception of the junior four-year-old class, the Milking Shorthorns experienced no change of class-leadership during 1927. It may be mentioned, however, that the record of Mr. A. J. Melville's Glenthorpe Lady, whose yield of 856·85 lb. butterfat places her at the head of the mature class, was closely challenged by Hon. Mrs. E. J. Blyth's Braeside Sweet Nell 2nd with the excellent performance of 851·21 lb. The new leader of the junior four-year-olds, Matangi Matilda 4th, was also owned and tested by Mrs. Blyth, although bred by Messrs. Ranstead Bros. Matangi Matilda 4th's record is 630·38 lb. butterfat, which exceeds the yield of the previous leader, Matangi Nancy 2nd, by approximately 22 lb. The class-leaders now stand as follows:—

Table 10.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season. Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old. Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old. Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old. Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old. Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old. Matangi Matilda 4th	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Senior Four-year-old. Matangi Ruth 2nd ..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature. Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class-averages.

Twenty-eight first-class certificates were issued to Milking Shorthorns in 1927, compared with twelve for the preceding year The average yield of the twenty-eight cows certificated last year was 445·82 lb. butterfat, as against 508·89 lb. for 1926. Needless to say, however, the influence of individual records defeats satisfactory comparison on a class basis, while the matter of production for age is an important factor when grouping together, irrespective of age, such small numbers of records. The class-averages for this breed for the past two years are as follows:—

Table 11.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1927.		lb.	lb.
Junior two-year-old ..	7	347	6,985·7	310·26
Senior two-year-old ..	1	365	9,727·5	484·07
Junior three-year-old ..	..	..	..	..
Senior three-year-old ..	2	346	10,242·7	410·68
Junior four-year-old ..	2	355	13,941·5	587·40
Senior four-year-old ..	6	334	11,988·0	437·43
Mature	10	338	12,173·1	520·64
	1926.			
Junior two-year-old ..	3	346	10,448·8	435·19
Senior two-year-old ..	1	365	11,752·8	542·66
Junior three-year-old ..	1	300	8,978·2	361·77
Senior three-year-old ..	1	365	13,954·6	688·75
Junior four-year-old ..	1	361	10,142·8	402·19
Senior four-year-old ..	1	365	14,850·0	635·91
Mature	4	337	13,893·9	542·45

The following table shows the average, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914:—

Table 12.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	47	351	8,446·4	346·06
Senior two-year-old ..	24	347	8,511·8	347·17
Junior three-year-old ..	19	334	9,594·2	381·27*
Senior three-year-old ..	19	344	10,776·9	457·88
Junior four-year-old ..	18	349	10,883·2	440·58
Senior four-year-old ..	23	343	11,943·2	469·32
Mature	221	340	11,544·4	461·84
All	371	342	10,809·2	434·86

* No additional cows for 1927.

Milking Shorthorn C.O.R. Bulls.

One bull, Dominion Glaxo of Ruakura, was added to the Milking Shorthorn list during the year, which now totals six. Of the bulls previously qualified only one, Matangi Pride, added to his C.O.R. daughters during the year. The figures for these two bulls are now as follows: Dominion Glaxo of Ruakura, 5—0—0—5; Matangi Pride, 10—0—0—10 (see key at head of Jersey bull list).

AYRSHIRES.

Class-leaders.

The period under review failed to bring any changes to the class-leaderships of the Ayrshire breed. Although several good records were authenticated during the year, none of the existing championship performances was seriously challenged. The list, which remains as at the close of 1925, is reprinted, as follows:—

Table 13.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Ivanhoe Stylish Daisy	A. M. Weir, Menzies Ferry	3 312	308·2	365	12,334·2	574·09
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Glencairn Brownie ..	A. Montgomerie, Kauwhata	8 360	350·0	365	15,579·4	728·05

Ayrshire Class-averages.

Although three of the four classes into which the Ayrshire breed is subdivided showed an increase in average yield for 1927 as compared with 1926, the average for the breed as a whole has decreased from 440·31 lb. butterfat for 1926 to 411·42 lb. for 1927. The explanation of the decrease is to be found in a study of the mature class for the two years. Out of sixteen Ayrshires certificated in 1926, ten were in the mature class, which that year was a particularly strong class, the ten representatives averaging 504·01 lb. butterfat. On the other hand, only three cows were in the two-year-olds, the lowest-yielding class. In the year under review seventeen Ayrshire cows received first-class certificates, but only five of these were in the mature class, whereas seven were among the two-year-olds. Moreover, the mature class in 1927 was weaker in quality as well as numerically, the average yield of the five cows being 472·78 lb. butterfat, as compared with an average of 504·01 lb. for the ten in 1926. The decrease is therefore not so

serious a falling-off as might at first appear. The Ayrshire class-averages for 1927, together with those for the preceding year, are as follows:—

Table 14.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1927.		lb.	lb.
Two-year-old	7	351	8,418·5	361·81
Three-year-old	3	324	9,853·3	415·35
Four-year-old	2	328	10,664·9	425·75
Mature	5	330	12,508·0	472·78
	1926.			
Two-year-old	3	339	6,454·6	274·22
Three-year-old	1	333	7,897·7	371·73
Four-year-old	2	365	11,426·2	405·22
Mature	10	360	13,125·0	504·01

The following table shows the averages, class by class, of all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912:—

Table 15.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	50	344	8,720·6	358·66
Three-year-old	30	345	9,817·3	402·29
Four-year-old	23	347	11,263·3	455·57
Mature	90	347	11,847·3	483·96
All	193	346	10,652·1	435·42

Ayrshire C.O.R. Bulls.

Only one name is to be added to the Ayrshire C.O.R. bulls as the result of the year's testing, making a total of seven to date. The new C.O.R. bull is Allandale White Hope, his figures being 5—0—0—5 (see key at head of Jersey bull list).

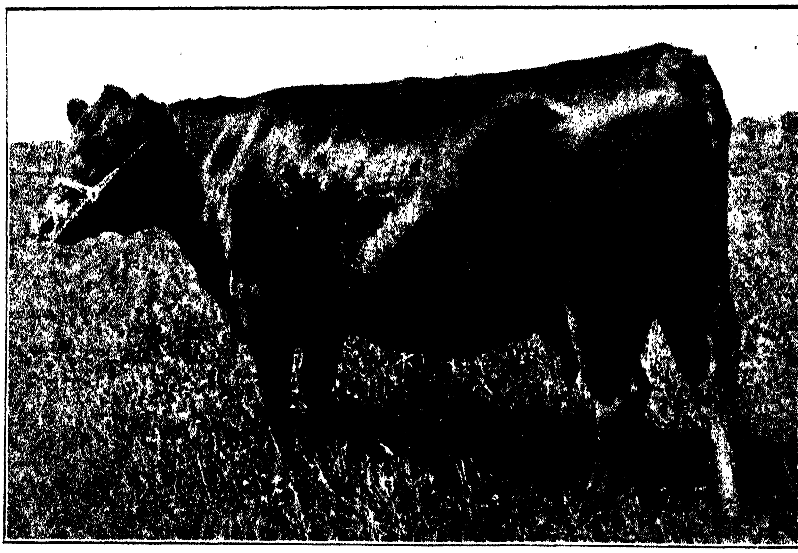
RED POLLS.

Class-leaders.

One change has taken place in the Red Poll class-leaderships, this occurring in the four-year-old class. Mr. B. W. Harvey's Susie Ann, with 448·48 lb. butterfat, yields place to Wayward 6th B No. 1, owned by Mr. G. S. Young, of West Plains, her record being 580·05 lb. This cow already holds the leadership of the two-year-old cla.s with a certificate for 511·42 lb. butterfat. Moreover, both her records are higher than any other for the breed. The full list is comprised in Table 16.

Table 16.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Butter-fat.
		Yrs. dys.	lb.		lb.	lb.
Two-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228·0	511·42
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Wayward 6th B No. 1	G. S. Young, West Plains	4 297	343·2	365	13,290·0	580·05
Mature.						
Dominion Sylph ..	Central Development Farm, Weraroa	5 4	350·0	365	11,009·00	505·84



WAYWARD 6TH B NO. 1 (G. S. YOUNG, WEST PLAINS, INVERCARGILL).
Leader of the Red Poll two- and four-year-old classes.

Red Poll Class-averages.

Twelve Red Polls gained certificates last year, an increase of two over 1926. All four classes were represented, although there was only one cow in the three-year-olds. This being so, comparison with the previous year's results is impracticable. The twelve Red Polls certificated last year averaged 372·23 lb. butterfat. Details are given in the following table:—

Table 17.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
	1927.		lb.	lb.
Two-year-old	7	351	7,780·3	329·75
Three-year-old	1	365	6,441·8	282·57
Four-year-old	1	365	13,290·0	580·05
Mature	3	365	11,369·4	431·98
	1926.			
Two-year-old	4	322	7,257·9	306·86
Three-year-old*	..	..	..	..
Four-year-old	1	354	11,109·3	448·48
Mature	5	312	9,239·3	385·13

* No three-year-olds under test in 1926.

The following table shows the averages, class by class, of all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 :—

Table 18.

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Two-year-old	33	341	7,596·4	337·49
Three-year-old	12	345	7,930·9	346·08
Four-year-old	6	343	9,909·1	425·86
Mature	18	331	9,072·3	421·32
All	69	339	8,475·5	368·54

Red Poll C.O.R. Bulls.

No new Red Poll bulls have been added to the list for this breed during the year, and none of the bulls previously qualified has added to his number of C.O.R. daughters. The three Red Poll C.O.R. bulls are Aviator, Belligerent, and Force Majeure.

We again extend our thanks to the secretaries of those breeders' associations who co-operate with the Dairy Division in the carrying out of the C.O.R. testing, and who each year render us much valuable assistance—Messrs. W. M. Tapp (Jersey), J. P. Kalaugher (Friesian), A. W. Green (Milking Shorthorn), R. H. Spencer (Ayrshire), and L. J. Wild (Red Poll).

CLOSING RECORDS FOR 1927.

Only one of the several outstanding records for the year 192 been completed since publication of the last C.O.R. list in the *Journal.* The particulars of this record are as follows : A

mature class—Bonnie Girl of Riki, tested by Atkins Bros., Manakau; age at start of test, 7 years 186 days; yield, 10,613·7 lb. milk, 424·66 lb. butterfat, in 263 days.

The fact that a certain number of owners have neglected to advise dates of calving subsequent to test, or to return necessary declarations for cows already qualified, signifies, of course, that the foregoing summary of C.O.R. testing in 1927 is not absolutely complete. The summary of results, however, is already overdue, and it was thought inadvisable to defer its publication any longer.

COMMON AILMENTS OF LIVE-STOCK AND THEIR TREATMENT.

J. Lyons, M.R.C.V.S., Director of the Live-stock Division, Wellington.

In a country such as ours, where many of those engaged in the primary industries are of necessity compelled to settle in somewhat inaccessible districts, and where transport is not always what could be desired, the lack of veterinary advice and assistance is at times acutely felt, and there are occasions when the farmer must be at a loss to know what to do in order to save the life of a valuable animal. Under such circumstances he is tempted to act on any advice given, whether it is correct or not, and more often than otherwise the dumb animal has to suffer. With a view to assisting settlers who find it difficult to obtain veterinary advice when required, the writer proposes to contribute to the *Journal* a series of notes on the common ailments of stock in this country, together with simple advice on their treatment. Incidentally it is hoped that such advice will help towards lessening suffering among the lower animals.

In order to be in a position to prescribe for ailments occurring among animals the practitioner must have a knowledge of anatomy, physiology, pathology, and also be acquainted with the action the medicines prescribed have on the animal. Without this knowledge one is more or less working in the dark, and much harm may be done, particularly in regard to medicine. It is amazing the faith many stockowners have in so-called remedies of which they are entirely ignorant. These remedies in some cases may result in neither good nor ill, while in others they may be actually harmful; and yet owners will persist in using such preparations for their stock, oblivious of the fact that they do not know what the remedies contain or the action they have on the animal's system. It is not intended to assert that all patent or proprietary medicines are harmful; many of them may serve a useful purpose. A word of warning is necessary, however, against those preparations which are advertised as specifics against diseases for which science has not yet discovered a remedy, and those for which the claim is made that they will cure all and every disease to which our live-stock is subject.

In connection with the first-mentioned category may be particularly mentioned the remedies guaranteed to cure abortion and mammitis in cattle which one sees advertised in many of our agricultural papers.

When the nature of these diseases is taken into consideration it is not difficult to understand how stockowners are deceived by agents selling such remedies. Abortion is due to an organism, and when once this gets into the system the cow becomes a carrier of the disease for life. This does not mean, however, that she will abort every time she gets in calf. She may do so for one or two seasons, after which she usually carries her calf the full time. Should an animal which has aborted be treated with one of the so-called remedies and carry her calf the full time the remedy gets the credit. The result would have been the same without treatment, and so a testimonial may be given where it is not merited. The same remarks may be applied to mammitis, although in this disease the organism may not remain permanently in the system.

If farmers would consult their veterinary surgeon or chemist, both of whom are better able to prescribe for their animals than the vendors of patent medicines, they would be better served at a much less cost. It would be pleasing to think that a warning such as this would have the desired effect. It is to be feared, however, that the individual with the ready tongue and plausible manner (whether by word or in advertisements) will too often continue to profit at the farmer's expense.

Before proceeding to a description of the symptoms and treatment of the more common diseases the importance should be emphasized of good nursing on the part of the stockowner or attendant, without which the best efforts of the physician or surgeon may be unavailing.

Tympany (Hoven) in Cattle.

Tympanites is purely a diatetic complaint, and is caused by the fermentation of food in the first stomach and generation of gases therefrom. It must not be inferred from this that all foodstuffs are given to fermentation. When undergoing the process of digestion it is only in certain classes of food that fermentation takes place, and then only when fed under certain conditions. It is a well-known fact that cows placed in clover pastures or pastures containing a fair sprinkling of clover in the spring of the year—when such pasture is succulent and damp—are apt to become blown; whereas later in the season the same pasture, when it has lost much of its succulence and the weather is dry, may be fed with impunity. In a climate such as ours, where the conditions are practically always more or less damp during the early spring months, such pastures must be fed with discretion if accidents are to be avoided and the best results obtained from the herd.

It is a common occurrence in many districts throughout New Zealand where clover is abundant for the cows in dairy herds to be in a more or less tympanitic state for weeks together, and mortality is not infrequent, more especially in damp weather. Under such conditions an adequate return cannot be expected from these herds. Much of the trouble could be avoided under a better system of animal husbandry. If the animals were kept overnight in a bare paddock or one which is free from clover, and given a quantity of good sweet hay (oaten hay for preference), so that the damp clover pastures were not taken on an empty stomach, the condition would be much less prevalent than at present, and it would also be found that an increased yield resulted. Although careful dieting will go far in eliminating

tympanites among our dairy herds, the complaint, under ordinary farming conditions, cannot be completely avoided at all times.

Treatment.—This will depend to a great extent on the severity of the case. In some instances, when the tympany is not of an acute nature, if the animal is given a few handfuls of good oaten hay or dry bran the swallowing of the material eaten sets up regurgitation, and the gas is expelled.

In the more acute cases the animal is so distressed that it will not partake of anything in the nature of food, and drenches have to be administered. For this purpose nothing seems to answer better than a wineglassful of turpentine in a pint of raw linseed-oil. The mixture should be well shaken before administration. Hyposulphite of soda and tincture of ginger, 2 oz. of each given in a quart of water, will also be found beneficial. In very acute cases, where there is danger of suffocation through the distended stomach pressing on the lungs and the animal is *in extremis*, relief must be given quickly, otherwise fatal results will follow. In such cases the animal's stomach must be punctured and the gas allowed to escape, and for this purpose a trocar and cannula should be used. The puncture should be made on the left side at the most prominent part, which will be found to be a few inches behind the last rib. While the puncture is being made the instrument should be held in a downward and forward direction, and when the puncture is completed the trocar should be withdrawn and the gas allowed to escape through the cannula. A long thin-bladed knife will also answer the purpose, but it is not so satisfactory, and should only be used when the trocar is not available. When the stomach is tapped by the knife method the gas does not come away so freely. This is due to the fact that as the gas escapes from the stomach the organ recedes. The opening in the walls of the stomach is thus dragged away from the opening in the abdominal wall, which prevents the escape of gas.

After a severe case of tympany it is always advisable to give the animal a dose of physic. A good prescription is ¾ lb. to 1 lb. of Epsom salts (according to the size of the animal) to which 2 tablespoonfuls of ground ginger have been added, the whole to be mixed in 3 pints of warm gruel or water and administered, after which the animal should be kept short of food for a few days. If this precaution is not taken, impaction of the stomach is liable to follow on account of the distortion to which it has been subjected.

Although clover pasture when fed in a wet or damp condition is by far the most frequent cause of tympany, this is by no means the only cause. There are other feeds which are also dangerous; in fact, any sudden change in feeding is also a causative factor. Turnips, green oats, ensilage, and brewer's grains are all liable under certain conditions to cause the complaint. Special care should be taken when feeding soft white turnips in damp weather.

Impaction of the Rumen (First Stomach).

This complaint is frequently seen as a sequel to tympany, or it may occur independently. It is caused by overloading the stomach with food.

Symptoms.—The animal is disinclined to move, and will often emit a peculiar grunt. The movements are more or less stiff, the head is

extended, and the back slightly arched, while if the stomach is pressed just behind the last rib a more or less " doughy " feeling will be in evidence, showing that the walls of the organ have lost their tone and have become paralysed. The appetite goes off and rumination is suspended, and if the animal is in milk the secretion for the time being is considerably diminished. Diarrhœa is a frequent symptom at the outset of the complaint, but this is of short duration, and gives place to entire stoppage of the bowel.

Treatment.—A good dose of purgative medicine is indicated in order to relieve the overloaded stomach, and for this purpose nothing answers better than 16 oz. of Epsom salts to which 2 oz. of ground ginger has been added. The whole should be dissolved in 3 pints of thin oatmeal gruel, and given as a drench. If at the end of twenty-four hours the medicine has not acted, it should be followed up with one-quarter of the ordinary dose, to be given every four to six hours until four doses have been administered. It must be remembered that in this complaint the walls of the stomach are inactive and have ceased to function, and that for treatment too much purgative medicine should not be used, as it only weakens and lowers the vitality of the patient. When purgative medicines fail to have the desired effect, much better results will be obtained from stimulants and tonics, and more particularly nerve tonics. From 2 to 4 drams of nux vomica to which 1 oz. of ground ginger has been added, and the whole dissolved in a pint of warm gruel, should be given three or four times a day. Meanwhile the animal should be kept in a sheltered place, and care taken that it is not subjected to extremes of temperature.

The opportunity may be here taken to give a general warning against the use of repeated doses of purgative medicine when treating cattle for digestive troubles. If such heroic treatment is practised it will be found that the end in view has not been accomplished, and that the resisting-powers of the animal have been weakened to such an extent that recovery is almost impossible. If after the administration of one or two full doses of purgative it is found that the desired result has not been obtained, it is useless and even dangerous to continue such a line of treatment. As already indicated, much better results will be obtained by substituting tonics and stimulants, combined, if necessary, with smaller doses of purgative.

Choking in Cattle.

This trouble is caused by a foreign body, such as a piece of turnip, apple, &c., lodging in the gullet. It causes considerable inconvenience to the animal, and may even cause death if the obstruction is not removed.

Symptoms. — The patient is very uneasy, breathes hurriedly, and coughs, and saliva is seen hanging from the jaws owing to the natural gases being unable to escape from the stomach. Tympany is frequently present, and the obstruction may be seen or felt in the gullet. In the majority of cases of choking it will be found that the obstruction has lodged in the upper third of the gullet. Under such conditions its removal is a more simple operation, and attended with less danger to the animal, than if the object had travelled farther towards the stomach before becoming fixed.

Treatment.—For the removal of such an obstruction the animal should be secured by an attendant, and the operator should then insert his hand and arm down the beast's throat until it reaches the obstacle, which can be grasped and removed. Meanwhile the obstruction should be pushed upwards and held in position from outside by a second attendant.

The dislodging of an obstacle which has settled beyond the reach of the operator's arm is a matter attended with considerable difficulty, and frequently with serious consequences to the animal unless the greatest care is exercised by the operator. In this case the obstruction cannot be removed through the mouth. Instead it has to be forced down the gullet until the stomach is reached. For this purpose a probang should be used, the instrument being inserted through the mouth into the gullet until the obstruction is reached and by gentle persuasion dislodged from its position. In such cases the operator should always be careful not to use undue force, otherwise there is danger of rupturing the organ. To avoid this, when the obstruction is reached, the instrument should be withdrawn a few inches, and then quickly and without too much force be brought on the obstruction again; in fact, the obstacle should only be tapped. This in the majority of cases will dislodge the obstacle from its position, and when thus moved it will be found that the muscular action of the gullet carries it into the stomach. It is advisable, however, that the instrument be made to follow the obstruction into the stomach, so as to make sure that the purpose has been accomplished. At the same time the gases lodged in the stomach are able to escape through the probang.

It is seldom that a probang is kept for use on the ordinary farm. The writer, however, has been successful with a length of fairly flexible hose-pipe with the operating end smoothed and hollowed out. The success of the operation depends on knowing how much force to use without rupturing the gullet. Should the latter circumstance unfortunately occur during the operation, blood will invariably appear on the instrument. When it is withdrawn a further swelling will appear around the animal's shoulders, and when pressed the part will have a feeling as if the hand were in contact with stiff paper. This is due to the gases in the stomach passing through the rupture in the gullet and lodging underneath the skin. Under such circumstances the case is not worth persevering with, and the animal should be destroyed.

In cases of choking, more particularly if the case has been a prolonged one, the animal should be kept on a light and easily masticated diet for a few days after the operation, so that the soreness may disappear from the throat. Otherwise the trouble is liable to recur. Further, if tympany is present a light dose of physic is indicated.

(To be continued.)

British Phosphate Commission's Business.—For the year ended 30th June, 1927, the production of phosphates at Nauru and Ocean Islands amounted to 594,825 tons, and sales by the Commission realized a total of £780,000. The Commission's assets were valued at £3,730,000. Liabilities included £1,440,000 owing to the British Government, the same amount to the Australian Commonwealth, and £548,704 to New Zealand.

PASTURE TOP-DRESSING EXPERIMENTS IN OTAGO, SEASON 1927-28.

(Continued.)

R. B. TENNENT, N.D.D., Instructor in Agriculture, and A. A. HUME, A.R.C.Sc.I., Assistant Instructor in Agriculture, Dunedin.

CENTRAL OTAGO.

WITH a view to ascertaining the effect of fertilizers on grassland in the semi-arid region of Central Otago, eleven plots were laid down in that district, three of these being on irrigated pasture, and the remainder on non-irrigated pasture.

In connection with the irrigated plots, it was realized that in order to obtain accurate results even watering over the whole plot would be essential, and, further, that irrigation would have to take place at such times as to ensure maximum growth for harvesting. In the case of two of the irrigated plots this was done. In the case of the third insufficient water was applied, with the result that extremely scanty growth took place over the whole plot, thus giving very inconclusive results. In viewing the results of these irrigated plots it must be borne in mind that under the arid conditions prevailing—namely, some 14 in. of rainfall per annum—the limiting factor of pasture-growth is soil-moisture. Growth can only take place when this is supplied by irrigation. No amount of artificial fertilizer can take the place of water. The top-dressing of pastures in the drier parts of Central Otago must therefore be looked upon as supplementary to irrigation. The results of the experiments for Central Otago are as under:—

Irrigated Pastures.

(12) L. RYAN, GALLOWAY.

This plot is situated on an easy slope of mica-schist soil on Galloway Flat. The pasture was more than twenty years old, and composed practically of rye-grass and white clover. Other grasses, such as Poa pratensis and suckling-clover, were interspersed throughout in small quantities. From a stock-feeding point of view there was undoubtedly too great a preponderance of rye-grass. It was anticipated that top-dressing would induce a stronger growth of clover. The plot was top-dressed on 2nd August, 1927, closed to stock on 10th October, and harvested on 12th December. Results were as follows:—

Table 10.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.			
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.	
24	Basic slag ..	40·0	S	1	14	3	8	13	9	0	15	0	1	12	6	(gain)
24	Basic slag and lime	35·1	N	1	10	2	7	12	6	1	8	0	0	1	9	(loss)
30	Superphosphate ..	48·3	S	2	2	0	10	10	0	1	1	0	3	2	9	(gain)
30	Super and lime ..	46·3	S	2	0	1	10	1	3	1	14	0	2	1	0	(gain)
36	Lime	31·7	N	1	7	2	6	17	6	0	13	0	0	1	9	(loss)
..	Control.. ..	29·1	..	1	5	1	6	6	3	..			..			

Summary: Lime showed little increase over the unlimed portions. Superphosphate undoubtedly gave the best results, not only in weight but in composition. White clover and suckling-clover showed vigorously increased growth on those plots top-dressed with super. Basic slag also showed increased clover-growth, but to a less marked degree. This plot was evenly irrigated during growth, the results being quite uniform.

(13) R. TOHILL, RAGGEDY RIDGE, GALLOWAY.

This pasture, sown down in 1922, was composed at the date of top-dressing of rye-grass, white clover, Poa pratensis, crested dogstail, and various weed plants. Situated at a fairly high elevation on Raggedy Ridge, it represented a moderate acreage of similar country. Top-dressing took place on 3rd August, 1927, the plot was closed to stock on 1st October, and harvested on 13th December, Results were as below:—

Table 11.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
20	Basic slag ..	4·0	N	0 3 2	0 17 6	0 15 0	0 12 6 (loss)
20	Basic slag and lime	4·2	N	0 3 3	0 18 9	1 8 0	1 4 3 (loss)
20	Super	3·4	N	0 3 0	0 15 0	1 1 0	1 1 0 (loss)
20	Super and lime ..	3·9	N	0 3 2	0 17 6	1 14 0	1 11 6 (loss)
25	Lime	4·0	N	0 3 2	0 17 6	0 13 0	0 10 6 (loss)
..	Control.. ..	3·5	..	0 3 0	0 15 0	..	..

Summary: The results on this plot were unsatisfactory, very little growth having taken place. This fact can be solely accounted for by the sparing amount of water applied to the crop. It is anticipated that next year more frequent irrigations will be given, and thus afford a better index to the efficacy of the different fertilizers employed.

(14) G. GARTLY, SPRINGVALE.

The pasture utilized for trial had been sown down six years previous to top-dressing, the chief constituents being perennial rye-grass and red clover. Situated on the western slopes of the Manuherikia Valley, this plot lent itself admirably to even irrigation, and as a result the growth at time of harvesting was most uniform throughout. Top-dressed on 4th August, 1927, the pasture was closed on 1st October, and harvested on 12th December, with results as shown in Table 12.

Summary: Marked differences were observed on the plots treated with superphosphate with and without lime, as compared with the control plots, white-clover growth being most prolific in the superphosphate strips. Basic slag with and without lime also showed up strongly, but to a lesser degree than those strips dressed with super. It is interesting to note that the limed strips gave an appreciable increase in yield over the control strips.

Table 12.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	30·1	S	1 6 1	6 11 3	0 15 0	0 8 9 (gain)
30	Basic slag and lime	32·9	S	1 8 3	7 3 9	1 8 0	0 8 3 (gain)
30	Super	38·5	S	1 13 2	8 7 6	1 1 0	1 19 0 (gain)
30	Super and lime ..	43·3	S	1 17 3	9 8 9	1 14 0	2 7 3 (gain)
40	Lime	30·2	S	1 6 2	6 12 6	0 13 0	0 2 0 (gain)
..	Control.. ..	24·5	..	1 1 2	5 7 6	..	..

Non-irrigated Plots.

(15) R. J. E. SMITH, WEDDERBURN.

The pasture selected for this trial had been sown down in 1922 with a mixture composed mainly of perennial rye-grass and red clover. At the date of top-dressing, on 6th August, 1927, the pasture was decidedly weak and open, the red clover had disappeared, and browntop with a slight covering of white clover was mainly predominant. The plot was closed to stock on 21st September, and harvested on 14th December. Results are tabulated below:—

Table 13.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	5·4	S	0 4 3	1 3 9	0 15 0	0 13 9 (loss)
30	Basic slag and lime	6·1	N	0 5 1	1 6 3	1 8 0	1 4 3 (loss)
30	Super	9·9	S	0 8 3	2 3 9	1 1 0	0 0 3 (gain)
30	Super and lime ..	10·4	S	0 9 0	2 5 0	1 14 0	0 11 6 (loss)
40	Lime	5·7	N	0 5 0	1 5 0	0 13 0	0 10 6 (loss)
..	Control.. ..	5·1	..	0 4 2	1 2 6	..	..

Summary: By observation no differences could be noted on any of the strips treated with the various fertilizers. At date of harvesting the general growth all over the plot was poor, and it would have been more advantageous to have delayed harvesting till a later date. This, however, could not be done. As will be observed, the general yield from the different treatments is low, but quite appreciable gains were recorded on those strips treated with superphosphate. Neither basic slag nor lime showed significant increases.

(16) J. CRUTCHLEY, KYEBURN.

A plot was established on the Kyeburn Flats, on soil of a light loamy nature. The pasture selected represented a fairly large area of similar country. The pasture top-dressed had been sown down with rape in 1921, a mixture of rye-grass and white and red clover being used. At the date of top-dressing, on 10th August, 1927, the pasture had run out badly, goose-grass and brown-top showing up strongly. The plot was closed to stock on 1st October, and harvested on 15th December. Following were the results:—

Table 14.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	14·6	N	0 12 3	3 3 9	0 15 0	0 6 3 (loss)
30	Basic slag and lime	15·4	N	0 13 2	3 7 6	1 8 0	0 15 6 (loss)
30	Super	44·7	S	1 19 0	9 15 0	1 1 0	5 19 0 (gain)
30	Super and lime ..	47·9	S	2 1 3	10 8 9	1 14 0	5 19 9 (gain)
40	Lime	12·8	N	0 11 1	2 16 3	0 13 0	0 11 9 (loss)
40	Control.. ..	12·6	..	0 11 0	2 15 0	..	..

Summary: As will be observed from the above table, superphosphate and lime gave the greatest yield, this being largely accounted for by the remarkably heavy growth of white clover growing on strips receiving this treatment. Those strips sown down with superphosphate alone also gave an excellent response, and to the eye the difference between them and the control strip was most striking. Basic slag with and without lime appears to have had little effect. Lime alone does not show results.

(17) S. C. GREER, PATEAROA.

The pasture selected for this experiment had been sown down in 1912 with a mixture of rye-grass, white clover, and crested dogstail. The pasture previous to this trial had not received any manurial treatment. At the date of top-dressing, on 10th August, 1927, it showed signs of considerable deterioration, the presence of a fairly large proportion of sweet vernal and Yorkshire fog being noted A good sole of white clover existed on the pasture. The plot was closed on 8th October, and harvested on 15th December. Table 15 gives the results.

Summary: The strips top-dressed with superphosphate showed up very early after closing the plot, and gave a remarkably good yield. The increased yield over the control strips was due largely to increased white-clover growth, which showed up to the eye in a striking manner. This plot was another instance of the efficacy of superphosphate during its first year of application. The application of lime alone has not given results during the first year, yet a significant increase is noted

in basic slag plus lime as against basic slag alone. A similar increase is to be noted in comparing super plus lime against super alone.

Table 15.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
20	Basic slag ..	48·7	N	2 2 2	10 12 6	0 15 0	0 10 0 (gain)
20	Basic slag and lime	52·5	S	2 5 3	11 8 9	1 8 0	0 13 3 (gain)
30	Super	60·9	S	2 13 1	13 6 3	1 1 0	2 17 9 (gain)
30	Super and lime ..	64·0	S	2 16 0	14 0 0	1 14 0	2 18 6 (gain)
30	Lime	41·2	N	1 16 0	9 0 0	0 13 0	1 0 6 (loss)
..	Control.. ..	42·9	..	1 17 2	9 7 6	..	..

(18) M. A. KINNEY, HYDE.

The pasture used for this experiment is situated on rolling country, the soil being of a light nature. The annual rainfall of this district is low, and heavy grass-growth is exceptional. Sown down in 1906, the pasture had run very largely to brown-top, there being only a small proportion of rye-grass and white clover present. The plot was top-dressed on 11th August, 1927, closed to stock on 8th October, and harvested on 15th December, with results as under:—

Table 16.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	13·5	N	0 11 3	2 18 9	0 15 0	0 6 3 (loss)
30	Basic slag and lime	14·8	N	0 13 0	3 5 0	1 8 0	0 13 0 (loss)
30	Super	26·5	S	1 3 1	5 18 9	1 1 0	2 7 9 (gain)
30	Super and lime ..	27·9	S	1 4 1	6 1 3	1 14 0	1 17 3 (gain)
40	Lime	12·7	N	0 11 1	2 16 3	0 13 0	0 6 9 (loss)
..	Control.. ..	11·4	..	0 10 0	2 10 0	..	..

Summary: As will be noted, the growth of grass was light throughout. Despite this fact it is extremely important to record that on those strips top-dressed with superphosphate a dense growth of white clover took place. On pastures of this description such a clover growth is extremely valuable, and is exactly what the pastoralist is seeking. The tabulated results emphasize the fact that super plus lime and super alone gave a much heavier all-round growth of herbage than the control strips. Lime alone and basic slag plus lime gave no appreciable increase.

(19) ROBERTS AND CO., MIDDLEMARCH.

The pasture selected for this trial represented a large acreage of similar country. Sown down in 1921, it still remained a fairly good pasture at time of top-dressing, being chiefly composed of rye-grass, cocksfoot, and white clover. Sweet vernal and brown-top were beginning to intrude, however. The plot was top-dressed on 12th August, 1927, closed to stock on 8th October, and harvested on 16th December. Results were as follows:—

Table 17.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
24	Basic slag ..	15·0	N	0 13 0	3 5 0	0 15 0	0 2 6 (loss)
30	Basic slag and lime	16·9	S	0 14 3	3 13 9	1 8 0	0 6 9 (loss)
24	Super	25·5	S	1 2 1	5 11 3	1 1 0	1 17 9 (gain)
28	Super and lime ..	26·5	S	1 3 1	5 16 3	1 14 0	1 9 9 (gain)
35	Lime	16·4	S	0 14 1	3 11 3	0 13 0	0 5 9 (gain)
..	Control.. ..	11·0	..	0 10 2	2 12 6	..	..

Summary: Those strips top-dressed with superphosphate showed up to a much better degree than strips receiving other treatment. The increase of white clover on the superphosphate strips stood out quite conspicuously, and accounted mainly for the increase in weight over the control strips. Lime alone showed a significant increase, but basic slag alone did not show any visible signs of having improved the pasture. On first year's results super plus lime and super alone proved much superior to any other treatment.

(20) J. BECK, OTUREHUA.

This plot, situated on rolling-downs country under dry conditions, consisted of a pasture sown down in 1922. Although sown to cocksfoot, rye-grass, crested dogstail, and white clover, at the time of top-dressing practically a pure stand of cocksfoot existed, and this was in a very open condition. Very little white clover was noted throughout the pasture. The plot was top-dressed on 5th August, 1927, and closed to stock on 1st October, but was not harvested. Strict observation was kept on this plot until the end of January. The rainfall during the growing-period was extremely low, and very little growth took place. At no stage could any apparent difference be noted from the various treatments. The growth did not warrant weighing. It is probable that, after the winter rains, interesting results will be obtained next season; for the season 1927–28 there is nothing definite to record.

(21) T. DOWLING, HYDE.

The pasture utilized for this experiment is situated on rolling country. Over twenty-two years of age, it was composed of brown-top, Danthonia pilosa, suckling-clover, and various weed plants. Of an extremely poor nature, it appeared inconceivable that results from

any manurial treatment could be obtained. The plot was top-dressed on 10th August, 1927, and closed to stock on 8th December, but was not harvested. Very little growth took place on the plot. The only difference noted was an increase in suckling-clover growth on those strips top-dressed with superphosphate. No other treatment appeared to have any effect, and at no stage did the state of the plot warrant cutting. On this year's result the expenditure on the various manures showed no justification.

(22) J. E. KEARNEY, RANFURLY.

This pasture had been laid down in 1904 with rye-grass and white clover. During the early part of season 1927–28 the rainfall was extremely low in this locality, and little growth took place on the plot. At the time of top-dressing, on 8th August, 1927, rye-grass and white clover still existed in the pasture, but in an extremely weak and open

FIG. 4.—TWO SUPERPHOSPHATE-TREATED STRIPS SHOWING UP ON J. E. KEARNEY'S FARM, RANFURLY.

condition. The plot was closed on 1st October, but was not harvested. Although the growth was of such a short nature as to preclude harvesting, the plot afforded a most valuable demonstration. The strips top-dressed with superphosphate stood out very clearly, and were composed of a solid mat of white clover, giving splendid feed. This clover-growth contrasted strongly with the miserable strips of untreated grass alongside. It was unfortunate that precise results could not be obtained by harvesting, but several photographs, two of which are here reproduced, were taken, and show how successful the

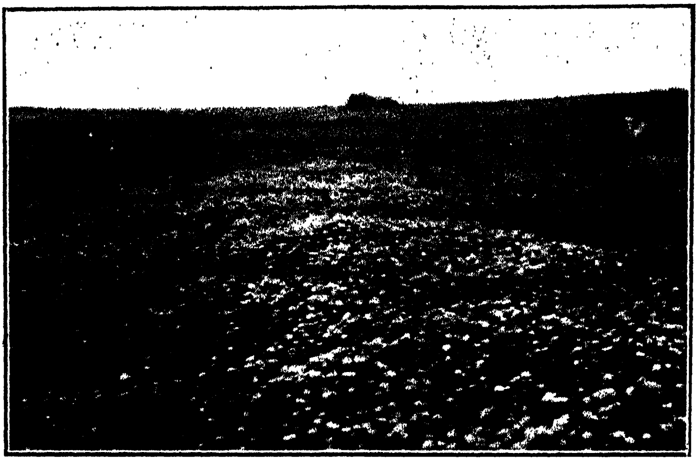


FIG. 5.—SUPERPHOSPHATE STRIP ON SAME PLOT AS FIG. 4, SHOWING DENSE MAT OF WHITE CLOVER.

application of superphosphate proved on this pasture. Superphosphate in this case undoubtedly justified its application, and proved an unqualified success in promoting good succulent clover growth. Neither basic slag nor lime gave any visible results.

(To be continued.)

CLASSIFICATION OF CATTLE IN NEW ZEALAND.

FOLLOWING are particulars of cattle in the Dominion (including boroughs) for the last two years' enumeration, as compiled by the Census and Statistics Office:—

—	Number on 31st Jan., 1926.	Number on 31st Jan., 1927.
Bulls two years old and over, for stud—		
For beef purposes	12,908	11,972
For dairy purposes	45,945	46,870
Steers two years old and over*	394,547	384,525
Steers and bulls one and under two years old	169,249	158,459
Cows and heifers two years old and over, for dairying—		
In milk	1,181,441	1,181,545
Dry	122,415	121,680
Other cows and heifers two years old and over ..	535,273	482,973
Heifers one and under two years old ..	401,013	384,743
Calves (heifer, steer, and bull) under one year old	589,695	484,962†
Totals	3,452,486	3,257,729

* Including bulls not kept for stud purposes. † Comprising 357,658 heifer and 127,304 steer calves.

THE FEEDING OF LIVE-STOCK.

J. McLINDEN, M.R.C.V.S., N.D.A., Officer in Charge, Animal Husbandry Branch, Live-stock Division.

III. FOODSTUFFS IN COMMON USE—*continued.*

ENSILAGE.

THE making and feeding of silage is by no means a recent innovation in this country, but circumstances are making its use more general, especially in connection with dairy-farming.

If green crops are cut and put into stacks and left exposed to the air the material undergoes a process of decomposition, due to various agents, which renders it unfit for consumption. But if the same crop is cut and stacked and these processes are kept in check and under control the result is a valuable foodstuff which is neither hay nor decomposed fodder.

It is sometimes stated that by making silage it is possible to save a crop that could not be made into hay owing to wet weather. That is true to an extent, but the best of silage cannot be made out of inferior material such as spoilt hay. The process of converting such hay into ensilage will never restore the lost nutritive value, though it may save the material from complete waste. If the crop to be ensiled is too wet when being handled it will never finish so well. This must be recognized also from the importance of having good dry fodder and good succulent root crops for winter feeding of dairy cows. Silage should be used to replace the roots rather than the hay. Where labour difficulties exist, or in late districts and wet seasons, it is not possible to make good hay, and here is where ensilage-making is valuable, especially where fodder is scarce.

Before a crop can be regarded as suitable for silage-making it must give a reasonably good yield per acre. It must lend itself to close packing also. That is how maize is so suitable for the process. Being solid-stemmed, once it is cut up the air is more or less easily excluded compared with crops which are hollow-stemmed. The hollow-stemmed crops need great care, and if this is not exercised moulding is sure to take place, with bad results in feeding. The ensiled crop should also have a fair percentage of soluble carbohydrates, for it is these which form the lactic and other organic acids which so effectively control the whole process. A crop of high protein content is good but for the fact that it is liable to putrefy. This is prevented if there is also present an abundance of soluble carbohydrates.

Maize is without doubt the most suitable crop for silage-making—hence the great extent to which it is used in America. The most important materials, so far as we are concerned, are the grasses and clovers and lucerne, while, generally speaking, the most suitable all-round special crop is oats with a mixture of legumes, such as peas, beans, vetches, or tares. Some districts, of course, have the opportunity of making maize ensilage. The oat and legume crop may contain a little too much protein for an ensilage of the best keeping-quality, but if handled properly its feeding-value, especially for milk-production, is greatly increased. It is also more suitable for feeding to young pigs.

Silage-making.

Silage is made in either a tower silo, a pit, or a stack. In other countries the tower silo has gained in favour over the older methods, due to the superior results obtained by its use. All the methods adopted aim at the one thing, and that is the exclusion of air from the mass. The processes going on are those of respiration, which is controlled by the amount of air admitted into the stack, fermentation, and bacterial activities, and, although not required, putrefaction in varying degrees. The process of fermentation, which is the chief, is controlled by the combined action of all the factors. A stage of temperature is reached which is too high, and therefore inhibits the process, and also the products of fermentation itself and the bacteria, reaching a degree of concentration which checks further development. The bacteria which are in the crops at this time split up the carbohydrates into oxygen, and reduce the sugars to organic acids, of which acetic is the chief, and also lactic. It is for this reason that leguminous crops do not make the best ensilage; they do not possess sufficient carbohydrates, and so there is a shortage of lactic acid. This, combined with protein putrefaction, produces a bad-smelling, unattractive food. Leguminous crops should always be ensiled with a starchy crop. The height to which the temperature is allowed to rise is also important, and this depends on the amount of air which is left in the crop when stacked. The wetter the crop, and the more tightly it is packed, the less air will be present in the stack. When the crop is tightly compressed the temperature remains low, and if much air is admitted the temperature will rise accordingly, to the extent of charing even. The various types of silage made depend on this control of temperature.

So far as these notes are concerned, it will suffice to say that more air, and therefore higher temperature, results in silage of the sweet type, while less air and lower temperature gives the sour type. There are all the degrees existing between these two; in a tower silo the full range is usually to be found.

Types of Silo.

By far the most economical and satisfactory silo is the cylindrical type. It may be constructed of various materials, such as reinforced concrete, brick, wood, and sometimes steel. By using this type the ensiled material is ensured of having plenty of pressure, except towards the top. This excludes the air, and so produces a sour silage, which is the most nutritive because less amounts of carbohydrates are utilized in its making. For the clamp and pit silo the driest area available is selected, and an excavation cut about 5 ft. deep, about 15 ft. wide, and as long as is needed. The fodder to be ensiled is never cut as in the tower silo, but simply flung into the bottom of the clamp and well tramped down. It is customary, once it has reached a sufficient height, to pull the carts over it to further compress it. The clamp is closed by covering over with turfs and earth. There may be a fair amount of loss by this method, due to water at the bottom of the clamp. The hillside silo, which is coming into increasing use in this country, is an adaptation of the clamp and pit style. The stack method of silage-making, although so far the most commonly employed in New Zealand,

is for several reasons the least satisfactory, and should really be regarded as only suitable for emergency work.

Feeding Silage.

In order to obtain the best results from feeding silage it is much preferable to use it as a substitute for roots instead of as a fodder (such as hay). It is really a succulent food containing a great amount of nutriment in a very digestible condition. Although that is so, it must also be remembered that a comparison between roots and silage from a chemical point of view shows the silage to have a far higher dry-matter content, and in this respect the diets are not interchangeable. But all that need be done to overcome this is to reduce the amount of fodder allowed when silage is being substituted for roots. From experiment it has been found that a 40 lb. ration of swedes may be substituted advantageously by a silage ration of 24 lb. when the silage is made of oats and mixed legumes.

The feeding use of silage is simple, and is advantageous to all stock except pigs. Cattle will consume 20 lb. to 30 lb. a day, and horses up to about 14 lb. a day. Calves can masticate it early, but it should not be fed to them under weaning-age. Bulls should only receive limited quantities, as it is liable to make them paunchy and slow at breeding. Good silage will not taint milk, but it should be fed after milking.

HAY.

A very large number of grasses and clovers, and sometimes oats combined with legumes, are used in the making of hay, and just as the composition of the mixture of grasses varies from field to field and farm to farm, so does the feeding-value of the resulting hay. The better the making of the hay the better will its feeding-value be. Clovers and lucerne are specially valuable owing to their high percentage of protein, but both these hays require very skilful handling, or a great proportion of their fine leaves will be lost, and it is in them that the feeding-value lies.

Haymaking should take place when the greater part of the field is in flower. It is a loss to cut too early, for the total cut would be reduced, but from a feeding point of view it is better to cut early than late. One cannot wait till the whole field is in flower or has flowered, for by that time the nutriment would have passed out of the hay and left it almost like straw. The Danish Agricultural School at Maesgaards, experimenting with clover hay, found that 200 lb. of early-cut hay produced 16¼ lb. more milk than did an equal quantity of hay from the same crop cut later. It was also found to be better for calves.

Although it has been said that the best time to cut hay is when most of the herbage is in flower, discretion must be used according to the weather conditions. That does not mean, of course, that where a hay crop is ready to cut, say, before Christmas, the work should be deferred until after New Year. That would be postponing the operation too long; yet it is a very frequent occurrence. Haymaking has perhaps always been done after New Year, and it would seem that numbers of farmers are determined that it will so remain. Speaking

generally, a great deal of the feeding-value of much of the hay in New Zealand is lost because it is cut long after seeding. In this condition it is little better than straw.

Once the cutting has started, provided the weather remains favourable, the hay should be handled as little and as gently as possible, and the process completed by stacking at the earliest possible moment. If it is stacked too early, due to improper drying, owing to, say, too thick a swath for the prevailing weather, the hay will "sweat" badly in the stack, and become brown in colour and have a not unpleasant odour. Provided that this does not go too far, the food value of the hay still remains good.

Of the common hays, rye-grass and clover is one of the best for milk-production, being generally higher in protein than the other mixed hays. In those districts where timothy hay is grown it is good practice to add clover to the timothy, the addition of the protein from the clover proving very beneficial. Timothy hay alone is much favoured by horses. It suits their taste, and they always do well on a feed or foddering of timothy. This grass as hay, even when cut after seeding, retains a very high feeding-value, so that although it has run to seed it is still of considerable value for horse-fodder or for making into horse-chop. Hay crops made from oats combined with peas, beans, tares, and vetches are very suitable for dairy cows.

The nutritive value of hays varies greatly, as would be expected. The value depends on the grasses going to make the hay, the condition in which it was made, the age of the pasture, and its treatment as regards manuring. Old pasture which has received little or no attention and has been practically unmanured is almost sure to be deficient in mineral matter. Where two cuts of hay are procurable in the season the second cut is the best from the nutritive point of view. It sometimes happens with lucerne that the second cut is made into silage, but it is better from the feeding point of view to make the first cut into ensilage and the second cut into hay.

On the farm the feeding of hay should be made the basis of the rationing of the stock, according to the quality and quantity available. One important point to be observed is care in the change of diet, especially with horses. New hay appears to be very indigestible for horses at first, for if carelessly fed it nearly always causes indigestion, colic, and not infrequently impaction of the bowels, which is a serious condition. "Broken-winded" horses should always receive their hay chopped and damp. Mouldy hay, such as is found in stack-bottoms, should not be fed to stock; it is dangerous, and more so if it becomes wet. Many a cow has been lost through feeding wet, mouldy hay. It is as well to add that salt or molasses water does not improve it in any way. Treated in this way it may be eaten more readily, but it is no less dangerous.

Hay is an important source of minerals for dairy cows in winter and spring, its value being determined, of course, by its quality. Where hay is fed as the sole roughage a dairy cow may be fed up to 20 lb. per day, and even over; where fed with roots or silage, 16 lb. to 10 lb. respectively, or slightly over; and where fed with straw and a succulent food it may be reduced to a daily ration of 5 lb. to 10 lb.

STRAW.

Straw is what remains after the seeds of a plant have been removed after ripening. The value of straw is very variable—much more variable, in fact, than that of hay. It is for this reason that some individuals maintain that straw has a good feeding-value—it varies so considerably in different farms. There is one aspect in which straw is always deficient, and that is its mineral value. It shows a high percentage of mineral, but this is chiefly silica, a substance of no feeding-value. Calcium and phosphates are deficient. It would not be prudent to advise the feeding of straw for any other purpose than merely to add bulk, except in the case of some samples of oat straw. Oat straw, especially of the older varieties, such as Tam Finlay, has a considerable feeding-value, but the other straws have practically none. Good samples of oat straw can be fed to horses, but only those doing slow work.

For dairy cattle oat straw is the only kind suitable for feeding to cows, but it only attains its highest feeding-value when fed together with a liberal allowance of roots. If it is to substitute hay in any quantity, then it must be augmented by feeding some concentrated food, such as bean-meal or linseed. This necessary addition practically rules it out of use, except for feeding to beef stock in favoured areas and to stores generally.

OATS.

Of the farm-grown grains, oats are by far the most popular for feeding purposes. The oat-sample should be plump and firm and have a bright and clear colour, as a dull colour indicates weathering. A good sample is always heavy for its bulk, but in this particular New Zealand has nothing to fear, generally speaking.

Oats stand alone for the feeding of horses. What it is that makes the oat protein of such value we have yet to learn. Oats have a great effect on the horse, and this can only be attributed to their being a well-balanced grain. The amount to be fed varies greatly with the kind of horse and the amount of work to be done. For hard-working horses an ordinary allowance would be about 20 lb. per day.

As a home-grown grain oats should commonly form part of the food for the dairy cow. It is one of the most economical sources of energy available, and when balanced with a food of higher protein content, such as beans, peas, &c., should form a considerable portion of the ration. The older varieties, such as Potato, Sandy, and Tam Finlay, have a higher feeding-value than some of the later varieties. No better grain than oats exists for milk-producing cows, and the only limit to their use is economy. Even when the price is high they are better retained on the farm and fed in preference to selling. Whenever possible they should be given to high-producing cows and those in pregnancy or poor in condition. They are a very safe food and palatable. They are better crushed when fed to stock.

For fattening stock oats are also good, especially for sheep. Lambs do extremely well on their mothers when these are fed on a little oats. With fattening cattle oats should not be too liberally fed, for if the feeding of the oats is stopped the animals will go off for a bit.

For calves, the feeding of oats is preferred when ground up and fed as oatmeal. Oatmeal and skim-milk will practically nourish a calf

as well as whole milk. Some claim that equally good results in calf-feeding are obtained with crushed oats. With pigs, there is rather too much fibre in the oat for their system of digestion and the age at which they are usually fed. If a portion of the husk is removed, however, oats are quite suitable.

WHEAT.

The only wheat available for feeding is that badly weathered or unsuitable for milling. It has a greater feeding-value than oats, but should never be fed finely ground, for it then forms an indigestible pasty mass in the digestive tract. For the same reason wheat should never be fed alone. Provided it is used with other foodstuffs and in small quantity it may be fed to cattle and pigs, but it is unsuitable for horses, as it causes skin trouble and even laminites (founder of the feet). It is the popular feed for poultry, and also forms the basis of most commercial mixtures for this purpose.

Wheat Offals.

Bran is the most valuable of the wheat by-products, especially for dairy cows. It is chemically better than oats in feed value, but practically about 1½ lb. of bran is required to equal 1 lb. of oats. Bran is rich in phosphorus and magnesium, but poor in lime (an important point to remember when feeding to dairy cows). Bran is an extremely palatable feed, and has a laxative and cooling effect on the digestive system. It is frequently too high in price for its value, but even then a little of it fed before and after calving of dairy cows is very beneficial, and also to high producers that may be receiving other rations. If roots are scarce, bran should be in use. Bran is fed to horses chiefly with the idea of preventing bolting of the grain feed, and for its laxative effect when used damp. Dry feeding of bran has a binding effect. The maximum ration of bran per day for horses and cattle should not exceed 3 lb. For pigs bran is not suitable, as it is far too fibrous and causes digestive troubles; the finer offals are more suited. If bran is fed to young stock it ought, owing to its deficiency in lime, to be used in conjunction with some leguminous foods such as beans or peas, preferably in the form of meal. Pollard is a very suitable food for pigs, but care should be exercised in buying, for it is very subject to adulteration.

When feeding the finer wheat offals to young pigs (for which they are quite suitable) their deficiency in lime is corrected by the use of skim-milk or buttermilk, but not whey. The finer offals are quite suitable for young pigs at weaning-time. The deficiency in lime may also be made good by feeding fish-meal or steamed boneflour. Pollards and middlings are unsuitable for dairy cattle. They are unpalatable to them, and cause digestive troubles, and are also uneconomical.

BARLEY.

In feeding barley its value may be regarded as better than that of oats, but not so good as maize; it is about similar to wheat. Barley is quite suitable food for horses, cattle, and pigs.

Barley-meal is used chiefly in the feeding of pigs. Some authorities contend that it is essential to the production of a first-class pork or

bacon. Provided the price is right, this contention may be accepted, but only then. Good pork can be produced by other foods also. The blind use of barley-meal is not to be advocated.

MAIZE.

Maize, with the exception of polished rice, is the greatest source of energy among all the cereals. It is essentially a carbonaceous food, containing approximately 70 per cent. of carbohydrates. It is low in protein and very poor in ash. It is palatable and readily eaten by all stock. Poultrymen prefer the flint variety. The grain, when fed, is very liable to form a doughy mass in the stomach if not combined with fibrous food. Fed in too great quantities it causes skin-eruptions. Maize is a very unbalanced food in many ways, and so should always be fed as part of a mixed diet. It is mostly used here for pig-feeding, and when comprising over 65 per cent. of the ration it is very liable to produce a soft carcass with a rather unpleasant flavour. Flaked maize is more digestible for pigs than raw maize. Maize provides many very useful and valuable feeding by-products, but so far they are of little interest in this country.

BEANS AND PEAS.

All leguminous seeds occupy a place of their own in the list of popular home-grown foodstuffs. Beans constitute a very valuable feed for dairy cows. They are usually fed to cattle and pigs in the ground state. In comparison with cereals they contain two to three times as much protein. For this reason beans are a very stimulating food, especially for milking-cows, which are greatly influenced to higher production by this food. The feeding of new beans should be avoided, as they are very liable to cause indigestion ; with care and rational feeding no ill results should follow. Beans are fed to horses, cattle, sheep, and pigs. The amount suitable for a horse varies according to the work which he is being called upon to do, but when they are the chief nitrogenous food 1 lb. to 3 lb., or even a little more, may be fed daily. Beans should never be fed whole.

Bean-meal is fed in considerable quantities in most dairying countries, but the practice of making it the only form of concentrates given is falling into disuse. It should be fed with more bulky foods, and when used in this way 4 lb. to 5 lb. will be a liberal allowance. Bean-meal very quickly deteriorates. Maize is greatly benefited from a feeding aspect by the addition of beans or bean-meal.

Peas are very similar to beans as a food. Peas and beans both have a tendency to make hard white butter, but only when fed in quantity. Pea-meal is fed similarly to bean-meal. New Zealand is well suited for the production of peas and beans, and one wonders why they are so comparatively little used by our dairy-farmers.

TREACLE OR MOLASSES.

This is a valuable foodstuff at times, if it can be procured at a reasonable price. It is essentially a carbohydrate food. It is palatable, appetizing, and laxative, but its only value really lies in making what would otherwise be unpalatable foods palatable—some qualities of hay, for example. It is a common constituent in proprietary stock-foods.

MEAT-MEAL.

Meat-meal was originally a by-product from the manufacture of meat-extract, and still is so; but with quite a considerable quantity of that now put on the market the meat has been passed through a digester and the fat extracted. A small proportion of finely divided bone is not objected to.

This type of food is very rich in protein and poor in carbohydrates. That means that it will be a very suitable food for all young growing stock as a flesh-former, and to any other stock whose functions cause a large demand to be made on the proteins or flesh of the body, such as deep-milking dairy cows, heavy draught horses, and racehorses. For young pigs it forms a very satisfactory adjunct to the diet.

Meat-meal is eaten by all types of stock, but it is advisable to introduce it gradually into the ration of dairy cows and horses. Used properly—that is, not in excess of requirements—10 per cent. of the total ration for young pigs, and 3 lb. to 4 lb. per day for dairy cattle—it gives a very satisfactory return, and the health of the animals fed with it is generally very much improved, resulting in greater economical production. There is no reason why the better grades of meat-meal should not be used, especially for pigs.

FISH-MEAL.

Fish-meal is a food which has come more or less into prominence recently, and consequently we hear a great deal about it—some reports being wellnigh on the verge of the phenomenal. It is very rich in protein, and also in minerals—chiefly lime and phosphate. No other type than the white fish-meal should ever be fed to stock, and then only if no more than 4 per cent. of salt be present. It is through the use of the inferior grade—owing to its tainting the flesh and occasioning serious losses—that fish-meal fell into disrepute. The second grade is only fit for manure. Recent tests on the feeding of white fish-meal have proved conclusively that it will not taint either milk, flesh, pork, or eggs. To be on the safe side the feeding may stop fourteen days or more before killing. The finest grades, however, can be fed right up to killing without causing taint. Cheap fish-meal should never be bought.

The composition of fish-meal makes it most suitable for the feeding of all young stock, and also for all breeding-stock. It is very suitable for pig-feeding. Its feeding-value is most marked when fed along with farm cereal grains, because it possesses an abundance of the elements comparatively lacking in such grain—mainly protein and mineral matter. As regards the quantity to be fed, although 2 lb. could be given to a dairy cow, the price would make it uneconomic. An amount equal to 5 per cent. of the ration will suit in most cases. With pigs no more should be fed than 10 per cent. of the total ration, or at most ½ lb. per day to adults.

WHALE-MEAT.

This product has only recently been marketed as a food for animals. For pig-feeding whale-meat has proved very satisfactory, and is believed to be superior to fish-meal. It is said to cause no taint, and the fat of the carcass is firm and of good colour.

THE BLACKBERRY PEST.

III. CONTROL—*continued.*

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(2) BIOLOGICAL CONTROL: INSECTS AND FUNGI.

THE possibilities of biological control in connection with the blackberry pest were taken into active consideration by the Department of Agriculture several years ago, and various local investigations were made. In 1924-25 as complete a study as possible on insect and fungous parasites attacking the genus *Rubus* in all parts of the world was undertaken, entomological and mycological authorities in many countries being communicated with. Some results of local work, and an account of the wider investigation, including the part taken by the Cawthron Institute, will now be given.

Parasites attacking Blackberry in New Zealand.

There are already in New Zealand a number of insects and fungi attacking blackberry to a greater or lesser degree. Occasionally one notices in newspapers statements concerning large areas of blackberry which are being "completely killed out" by some fungus. On investigation, however, there is, as a rule, not much foundation for such reports beyond the fact that a few patches in a large area are badly infected, having their canes partly or entirely withered, but without evidence that the plants would not send up fresh shoots in the following year. Unfortunately, this is practically always the case; the vines are killed for a season, and twelve months later the plant is as healthy as ever; only very occasionally is a small plant completely killed.

One of the most important of the fungi attacking blackberry is *Leptosphaeria Coniothyrium*—raspberry, unfortunately, being also parasitized by this fungus. In the life-history of *Leptosphaeria* there are two stages, and of these it is the conidial stage which does all the damage. This stage has been named *Coniothyrium Fuckelii* Sacc., and it is more severe on raspberries than blackberries. Infection is effected by means of a spore which germinates and penetrates the epidermis, underneath which a mass of hyphæ is soon formed. These very quickly penetrate to all parts, including the conducting system of the stem. Here they develop to such an extent, and so rapidly, that in a very short time the vessels are entirely blocked, and as a result the stem dies above the point of infection. Though this disease in some localities, and in some seasons, gives the appearance of having caused the death of many blackberry-bushes, or having prevented the ripening of the fruit on others, actually the real damage does not amount to very much, for its ravages are far too spasmodic; it is severe in a locality during one season, then next season practically non-existent. The disease is much more vigorous on raspberry.

The most interesting of these reports came from Feilding, and on investigation it was found that the suffering blackberry was situated on the banks of a stream and on the flat low-lying adjacent land.

Here the weed was found to be attacked by a number of parasites, the following being the most evident :—

(1) Rose scale (*Aulacaspis Rosæ*) : This insect was conspicuously abundant on the more sheltered stems, and has been reported from several other localities in New Zealand, but it does no more than restrict the growth of the infected plant.

(2) Bronze beetle (*Eucalaspis brunneus*) : This had caused a considerable amount of damage to most of the leaves, but it does little real harm to the plant.

(3) Leaf-tying caterpillar (*Tortrix excessana*) : This was present only to a very slight extent.

(4) Cane-wilt (*Leptosphaeria Coniothyrium*) : This fungus was more or less abundant. In other parts of New Zealand it has been found to weaken the plant. Here it was common on the long terminals, and was probably the cause of so many of these tips withering.

(5) Leaf-spot (*Septoria rubi*) : This was also very much in evidence, but not causing any damage. It is common wherever blackberry is found, and produces no more serious damage than a spotting of the leaves.

(6) Tip-wilt : The cause of this is unknown, and it is far from common, this particular area having it more in evidence than any I have ever seen. The manner in which the fruiting shoots are attacked is quite striking, and in some cases the wilt extends for 1 ft. or more down the shoot. It causes a premature withering of the developing fruit, which as a rule remains on the stalks in a dried condition. The fungi found in association with these diseased fruiting shoots are so weakly parasitic that at present they are not regarded as being the cause of the wilt.

This flat land, according to the owner, had not been flooded ; but it was evident from the silt on the old leaves of the bushes growing along the banks of the stream that they had been submerged, and here there was no sign of the "tip-wilt." On a later visit to this area the spring was well advanced, and it was very evident that the flooded creek-side bushes were greatly in advance and in a much more healthy condition than those on the flat, in spite of the fact that they had been subjected to a somewhat lengthy submergence during the winter and early spring.

At this visit it was noticed that there was something attacking the young shoots here and there, and this proved to be a stem-boring insect known as *Œcophora pseudo-prutella*, which itself is so heavily parasitized that it is not likely to do very much harm. Even in this locality it was not in great abundance. It seems that the parasite doing the greatest amount of damage is rose scale ; but this, as in the case of *Leptosphaeria*, only attacked the vines which were considerably advanced—there being no evidence of infection on the younger stems —though on all the old stems from the crowns to the terminals there was dense covering of *Leptosphaeria*, while only the protected stems low down near the crowns were infected with rose scale.

SURVEY OF BLACKBERRY AREAS.

As complete a survey as possible of all the blackberry areas in the North Island and a few parts of the South was made, and in this

I paid special attention to parasites attacking blackberry under the following conditions :—

Permanent swamp.	Hill country.
Temporary swamp-lands.	Roadside.
Flooded areas.	Plantations (well shaded).
Flat well-drained lands.	

Each of these will be considered separately.

Permanent Swamp.

Blackberry growing in areas of this nature was examined at Te Awamutu, Reweti, Woodhill, Kaukapakapa, Opotiki, and Wairoa. In none of these areas was tip-wilt visible, and the only parasites in evidence were bronze beetle (Fig. 26) and cane-wilt, both of which were abundant, while the plants were most healthy.

Temporary Swamp-lands.

These were examined at the following places : Te Awamutu, Ohaupo, Frankton (Waikato), Taupaki, Kaukapakapa, Maungaturoto, Hikurangi, Otiria, Tauranga, Opotiki, Wairoa, Tangoio, and Puketitiri. The only parasites found were the same as in permanent swamps, there being no sign of any borer or tip-wilt of the fruiting shoots.

Flooded Areas.

Plants growing on areas which had been flooded under very silty conditions were examined at the following places : Te Awamutu, Ngaruawahia, Mercer, Waimauku, Reweti, and Opotiki. Again the same two parasites were in great evidence, but the leaf-eaters (bronze beetle) had done far less damage. There was no sign of tip-wilt, and though in some cases—for instance, at Te Awamutu—the plants had been flooded (a process which seems of yearly occurrence here) just previous to the time of flowering, and all the stems and leaves had been thickly coated with a pure silt, flowering was general, and growth particularly dense and luxuriant. Farmers I talked with on the subject of flooding were most emphatic that long periods of flooding did not in any way damage the plant, even though the waters might leave large quantities of silt covering stems and all green parts; in fact, the bushes in every case seemed even more vigorous than under normal conditions. This is certainly what I found to be the case.

Flat well-drained Land.

Many areas of this class of country were visited, among others Te Awamutu, Hamilton, Taupiri, Huntly, and Auckland ; and many places in North Auckland, including Henderson, Swanson, Waitakere, Helensville, Whangarei, and Otiria ; other visits were made to Tauranga, Clive, Whakatane, Opotiki, Wairoa, Esk Valley, and Tangoio. Here again cane-wilt and bronze beetle were everywhere much in evidence. In addition, rose scale was present at Opotiki, Hamilton, and Auckland, while the rust *Kuehneola albida* was noticed to a small extent at Opotiki and Tangoio. This causes the wilting of shoots, sometimes as far as the crowns in some seasons in varied localities, but even in dense masses there is no general attack—only a few scattered stems here and there being infected. Another parasite in evidence to a small extent in Auckland, Waitakere, Otiria, Opotiki, and the Esk Valley was leaf-spot, a parasite which does little or no damage.

FIG. 26. SPECIMENS OF RUBUS FRUTICOSUS, SHOWING DAMAGE TO LEAVES BY BRONZE BEETLE.

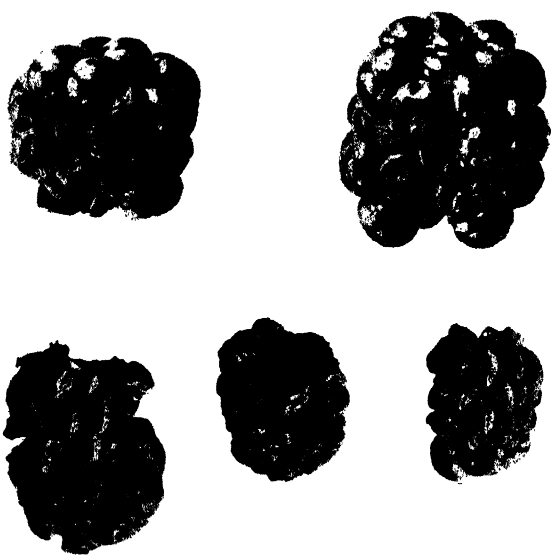

FIG. 27. RIPE BLACKBERRY FRUIT, SHOWING ATTACK BY FUNGUS WHICH DESTROYS FLESHY PART BUT LEAVES SEED UNDAMAGED.

[*Photos by H. Drake.*

Hill Country.

Blackberry growing on hill country was examined at Ngaruawahia, Waitakere, Kaukapakapa, Otiria, Wairoa, Opoutama, Mohaka, Tangoio, Esk Valley, and Puketitiri. In these places cane-wilt was everywhere abundant, as also was evidence of bronze beetle, but this was much more evident on the less exposed parts. Rose scale was in evidence at Opoutama and the Esk Valley, the rust *Kuehneola albida* was found at Tangoio, while leaf-spot was fairly common at Waitakere, Otiria, Esk Valley, Puketitiri, and Napier.

Roadside.

Roadside blackberry was very much in evidence in almost every town I visited, being particularly noticeable in Auckland, Wairoa, and northern Hawke's Bay generally. Here again the two persistent parasites, cane-wilt and bronze beetle, were by far the most abundant, with the addition in Auckland of rose scale and at Napier of rust. Here another factor comes in—the effect of dust. In many places the plants were very densely covered with dust, which in no way seemed to inhibit the vigorous growth of the plant or the flowering, the dust-covered bushes being just as healthy as the clean ones.

Plantations well shaded.

Plants growing in the bush were examined at Auckland, Glen Eden, Tangoio, and Patoka. The evidence of bronze beetle was slight, but cane-wilt was general. At Tangoio silver-leaf fungus (*Stereum purpureum*) was quite abundant, but doing no apparent harm.

BLACKBERRY PARASITES RECORDED.

In the North Island blackberry parasites have been recorded as follows :—

Taranaki—
- Longhorn beetle (at Midhirst).
- *Rhizopus arrhizus.*
- *Leptosphaeria Coniothyrium* (cane-wilt).
- *Aulacaspis Rosæ* (rose scale).

Thames—
- *Kuehneola albida* (rust).

Waihi—
- *Leptosphaeria Coniothyrium.*

Hastings—
- *Rosellinia radiciperda.*

From the South Island :—

Picton—
- *Carposnia adroptella* (blackberry-seed moth)
- *Chenochilon perforatus* (scale insect).

Blenheim—
- *Stereum purpureum* (silver-leaf).

Nelson—
- *Leptosphaeria Coniothyrium.*

Tasman—
- *Aulacaspis Rosæ.*

Hokitika—
- *Aulacaspis Rosæ.*

Christchurch—
- *Aulacaspis Rosæ.*

In no case were the bushes observed to be suffering in any way from these parasites.

SUMMARY.

To summarize, the following insects and fungi have been found to attack blackberry in various parts of New Zealand :—

Rose scale (*Aulacaspis Rosæ*).
Bronze beetle (*Eucalaspis brunneus*).
Leaf-tying caterpillar (*Tortrix excessana*).
Cane-wilt (*Leptosphaeria Coniothyrium*).
Leaf-spot (*Septoria Rubi*).
Stem-borer (*Œcophora pseudo-prutella*).

Rust (*Kuehneola albida*).
Tip-wilt.
Silver-leaf (*Stereum purpureum*).
Longhorn beetle.
Rhizopus arrhizus.
Rosellinia radicipersa.
Bud moth (*Carposina adroptella*).
Scale insect (*Chenochiton perforatus*).

None of these is found to be harmful to any great extent, and even where a plant is attacked by two or three of the parasites the damage is only very slight.

Parasites in England and France.

After insect and fungous parasites infesting blackberry in New Zealand had been investigated and none found to damage the plant to any extent, entomologists and mycologists in many countries abroad were circularized with a view to finding the parasites attacking blackberry and related plants throughout the world and to ascertaining if any could be utilized to combat the pest in New Zealand. Replies were received from over forty entomologists and mycologists, but from none was any information received concerning parasites which would be sufficiently effective to warrant their introduction.

In June, 1925, an entomologist connected with the Department of Agriculture (Dr. J. G. Myers) was abroad, and he was communicated with and asked to inquire into the matter of insect parasites as a means of controlling blackberry. He found that the natural enemies of blackberry in Europe are less conspicuous than those in New Zealand. They were studied in Suffolk and Kent, and again in France at Versailles. The information then available was practically negligible, and concerned usually only those raspberry pests of which blackberry is the original host. No root-attacking species were found. Insects affecting the rest of the plant included a few Lepidoptera (largely polyphagous), the raspberry-beetle (*Byturus tomentosus*), some Typhlocybid leaf-hoppers, a species of thrips, and certain gall-forming Cynipids and Cecidomyiids

Taking the foregoing in detail, we may first reject the Lepidoptera (butterflies and moths) as insignificant. Practically only the leaves are attacked, and the damage to the plant is small.

The raspberry-beetle, as a larva, attacks the fruit and renders it more or less unpalatable, but does not injure the seed. It is one of the worst pests of raspberry in England, and the adult beetles attack apple-blossoms and other flowers in early spring. Dr. D. A. Imms, of Rothamsted, while admitting the practical certainty that it would also attack our raspberries, thought that the question of introducing this beetle might be considered.

Several species of Typhlocybid leaf-hoppers live on the under-surface of the leaves, causing spotting and yellowing, as in the case of the species found at Wairoa, Hawke's Bay, and mentioned elsewhere. The damage as seen in Europe is more or less negligible, but Typhlocybids can become very destructive at times.

A thrips species causes a certain amount of castration by " blighting " the flowers.

There remain the gall-makers—forms which are likely to be more specific and thus safer than any of the preceding. There are three Cecidomyiidae and one Cynipid. Of these four forms three concentrate on the vegetative parts, while the fourth attacks the reproductive

organs. The Cynipid *Diastrophus rubi* Hartig produces galls in the shape of swellings on the stem. Similar damage is committed by the Cecidomyiid *Lasioptera rubi* Heeger, a gall-former which attacks raspberry and blackberry. It is parasitized heavily by several Hymenoptera (ants, bees, &c.). Concerning this insect Dr. R. J. Tillyard says, "As far as I can find out, these galls rather tend to stimulate than check the growth of the plant, the insect acting as a natural pruner."

Perrisia plicatrix H. Low is a midge whose larvae roll and twist the young leaves. It has never been recorded from raspberry. There are several broods each year.

Contarinia rubicola Rubsamen in the larval stage does the same damage as thrips, destroying the stamens in the young flowers. It has been recorded once from raspberry in Germany, but is not known to attack it in England. To quote from Dr. Myers: "If any insect enemies were introduced against blackberry the Cecidomyiids, especially *Perrisia* and *Contarinia* by reason of their specificity, would be the most promising. At the worst they might attack nothing more than raspberry, and at the best they might make some impression on the blackberry pest. Plant control by means of natural enemies is, however, a very dubious matter and one in which the utmost circumspection should be used."

However, if proper precautions are taken as regards transport, and later in testing, there should be no objection to the introduction of possible enemies of the pest. When the experimental work was commenced it would have been very unwise to introduce parasites into the Dominion, as there were not the necessary insectaries for the proper confining of the insects under strictly experimental conditions, and consequently the risk would have been far too great. At the present time we are in a very different position, since the Cawthron Institute, at the instigation of Dr. Tillyard, has been provided with large, well-equipped insectaries where parasites can be thoroughly tested without fear of accident. Any parasite now introduced into New Zealand is tested under the most rigid conditions, and it is determined definitely to what extent the insect will parasitize plants of economic importance.

Natural Enemies in other Countries.

The result of correspondence with entomologists and mycologists overseas was far from hopeful. The following list of parasites, compiled from these replies, gives the insects and fungi attacking the genus *Rubus* in all parts of the world:—

(1) FUNGOUS PARASITES.

Norway.

Gymnoconia peckiana.
Phragmidium rubi-idaei.
Phragmidium violaceum.
Phragmidium rubi.
Phragmidium rubi var. canicanti.
Phragmidium perforans.
Kuehneola albida.
Pucciniastrum arcticum.
Sphaerotheca humuli.
Coleroa chaetomium.
Leptosphaeria Coniothryium.
Didymella applanata.
Plectodiscella veneta.
Septoria rubi.
Peronospora rubi.

Italy.

Septoria rubi.

Egypt.

No record.

India.

Cercospora rubi.
Phragmidium Barclayi.
Hamaspora longissima.
Septoria rubi.
Phragmidium orientale.

Phragmidium rubi.
Phragmidium assamense.
Phragmidium incompletum.
Phragmidium burmanicum.

Ceylon.

Phragmidium sp.

Uredo.

South Africa.

Phragmidium sp.

Cronartium sp.

Australia.

VICTORIA.

No record.

SOUTH AUSTRALIA.

Septoria rubi.
Phragmidium barnardi.

Phragmidium subcorticium.

WESTERN AUSTRALIA.

No record.

NEW SOUTH WALES.

No record.

Canada.

SASKATCHEWAN.

Phragmidium imitans.
Gymnoconia peckiana.

Septoria.
Mosaic.

OTTAWA.

Septoria rubi.
Phytomonas tumefaciens.

Leptosphaeria Coniothryium.

United States of America.

NORTH CAROLINA.

Gymnoconia peckiana (Howe) Trotter.
Septoria rubi.
Cercospora rubi.

Fusarium rubi.
Gymnoconia peckiana.

NEW YORK.

Plectodiscella veneta.
Verticillium sp.

Mosaic.

MICHIGAN.

Gymnoconia peckiana.

Plectodiscella veneta.

KANSAS.

Septoria sp.

KENTUCKY.

Mosaic.

MINNESOTA.

Gymnoconia peckiana.
Kunkelia sp.
Microsphaerella rubina.
Leptosphaeria Coniothyrium.
Septoria rubi.

Plectodiscella veneta.
Phytomonas tumefaciens.
Mosaic.
Leaf-curl.

CALIFORNIA.

Gymnoconia peckiana.
Septoria rubi.

Phytomonas tumefaciens.
Botrytis sp.

WASHINGTON.

Gymnoconia peckiana. *Armillaria mellea.*

Jamaica.
No record.

Hawaii.
No record.

Trinidad.
No record.

Fiji.
No record.

Regarding fungous parasites, Dr. C. K. Shear, of the United States Department of Agriculture, Washington, stated :—

In so far as we are aware little or no practical success has ever been attained in destroying weeds by means of fungous parasites. We have no fungous parasites of *Rubus* sufficiently active to destroy any of our native or introduced species of *Rubus*. Of course, it is possible that some of these parasites might be more destructive in your country and on the species you are dealing with, but on the other hand it is possible, if not probable, that they might be less injurious to your species, and again if once introduced they might attack other species of *Rubus* or other plants which are of commercial value. It is very difficult to predict how any organism will behave when brought into contact with new hosts and a new environment, and in this case it seems to us possible, if not probable, that the danger would be greater than any benefit likely to be derived from the introduction of new parasites. Of course, it may be possible that there is some fungus which would be as destructive to your *Rubus* as the chestnut blight fungus is to our chestnuts, but I think the chances are small and the risks too great.

(2) INSECT PARASITES.

Italy.
No data.

Khartoum.
No data.

British Guiana.
No data.

India.
No data.

Barbadoes.
No data.

South Africa.
No data.

Cyprus.
No data.

Bermuda.
No data.

Hawaii.
No data.

Ceylon.
Natada Nararia (Fringed nettle grub).

Canada.

Byturus unicolor.
Oberea bimaculata.
Phorbia rubivora.
Synchlora aerata.
Monophadnus rubi.
Pamphilius fletcheri.
Prionus laticollis.
Bembecia marginata.
Œcanthus niveus.
Agrilus ruficollis.
Metallus rubi.
Synanthedon (Aegeria) rutilans.

United States (Washington State).

Agrilus ruficollis.
Oberea bimaculata.
Bembecia marginata.
Phorbia rubivora.
Hartigia abdominalis.
Monophadnus rubi.
Œcanthus nigricornis.
Tetranychus telarius.

Concerning the foregoing insects the following notes will be of interest:—

Byturus unicolor Say.—This is a small Dermentid beetle which feeds as a rule on the young leaves and buds of raspberry and blackberry. The larvæ feed on the mature fruit and sometimes cause a considerable amount of damage.

Oberea bimaculata Oliv.—The raspberry-cane borer, a slender, black Cerambycid beetle. The larval stage is spent burrowing in the raspberry-canes. It also has a fondness for roses to a limited extent, and each year is recorded as being very much in evidence.

Phorbia rubivora Coq.—The raspberry-cane maggot, a small greyish-black fly the larvæ of which tunnel in the raspberry-canes.

Synchlora aerata Fab.—The raspberry spanworm. The larvæ of this sometimes injure the fruit of raspberry and blackberry, but not to any great extent or to the extent of rendering the seed sterile.

Monophadnus rubi Harris.—The raspberry sawfly, whose larvæ work havoc on the foliage of raspberries and blackberries.

Pamphilius fletcheri Macq.—The raspberry web-worm, an insect which causes considerable destruction by webbing the terminal leaves together.

Prionus laticollis Drury.—The giant root-borer, one of the large long-horned beetles the larvæ of which bore into the roots of blackberry, grape, apple, and cherry. It may cause a considerable amount of damage, but favours too many hosts of economic importance to warrant a trial in this country.

Bembecia marginata Harris.—The blackberry-crown borer. The larvæ of this moth attack blackberries, timpleberries, and loganberries by boring into the roots and girdling them. In some places it becomes a very serious pest, and there seems every likelihood of it turning out a very useful parasite. Regarding this insect Dr. Tillyard says, "It can be controlled in raspberry by carefully cutting out the infested canes. Does not attack roses or any other plants. A vigorous insect of great potential value."

Œcanthus niveus DeG.—The snowy tree-cricket. Damage by this insect is done through the egg-punctures, but it is not of any great importance.

Agrilus ruficollis Fabr.—The red-necked agrilus. The larvæ of this attack blackberry, raspberry, and dewberry canes, causing gall-like swellings and at times doing a considerable amount of damage by killing the stems.

Concerning the insects listed from America attacking blackberry and raspberry, a very large range of orders is represented—*e.g.*, Coleoptera (beetles), Hymenoptera (ants and bees), Lepidoptera (butterflies and moths), Diptera (flies, mosquitoes, &c.), Hemiptera (cicada, aphids, lice), and Orthoptera (dragonflies, mayflies, earwigs). The most likely to do damage are *Agrilus ruficollis* and *Bembecia marginata* (both mentioned elsewhere). In the United States damage by these is not so very extensive on account of the vigorous control exercised against them, so it is impossible to say what damage they might cause if introduced into New Zealand where these control measures are absent. It is more than likely, however, that they would find blackberry a very palatable host.

Work of the Cawthron Institute.

In 1926 Dr. R. J. Tillyard, head of the biological branch of the Cawthron Institute, visited America and Europe, and took this opportunity to investigate fully the insect parasites of our noxious weeds, with the idea in particular of introducing into New Zealand those which seemed likely for the control of blackberry. Dr. Tillyard went on the understanding that permits for the introduction of parasites would be granted provided the following conditions, drawn up by the Department of Agriculture, were strictly adhered to :—

(1) No species to be forwarded from any country to New Zealand except such as are known to feed on species of the genus *Rubus* only.

(2) All shipments on arrival in New Zealand to be taken charge of by an officer of the Department of Agriculture, who shall examine the cages to see that they are intact, and that no insects can escape from them while being forwarded to Nelson. (This would allow of broken or damaged consignments being either destroyed or their cages repaired before forwarding.)

(3) Dr. Tillyard to furnish to the Director-General of Agriculture an account of the life-history of each species selected for study.

(4) The permits granted for introduction of all *Rubus*-feeding species to be permits restricting the study and rearing of such insects to closed insectaria and cages in the Cawthron Institute grounds and laboratories.

(5) All such insects to be thoroughly tested within such insectaria or cages on all important economic plants, particularly introduced Rosaceae, such as apples, pears, stone-fruits, roses, &c.

(6) If considered necessary similar tests to be made in country of origin before shipment.

Opinions regarding the introduction of fresh parasites differ very widely. Some people are strenuously opposed to importation under any circumstances. Others (generally those with large areas of blackberry) are clamouring for the Government to introduce any insect at all and set it free, no matter what the effect may be on the fruit industry so long as the blackberry will materially suffer. A third class consists of those who have given the matter much more mature and reasonable consideration, and consequently are willing that possible insect controllants should be very carefully studied in their natural habitat and an exhaustive investigation made concerning their range of hosts before they are introduced into this country; further, that with as full information at hand as possible the insects should be introduced under the strictest conditions of confinement in transport, and then kept under very rigid experimental conditions in specially constructed insectaries, where they may be tested on weed pests and also on all likely hosts of economic importance as laid down by the Department.

On his return Dr. Tillyard furnished a report in which he suggested that the following insects should be imported and studied, his remarks on the various species being given in abridged form :—

(1) *Insects which attack the Crown and Stem by boring or Gall-forming.*

Coroebus rubi Linn.—A Buprestid beetle which destroys up to 60 per cent. of the new stems in some seasons. Its larval attack on other members of the family is almost negligible. Only very occasionally does it attack the rose Frau Karl Druschki, while raspberry—the nearest relation of blackberry—is not parasitized at all.

Agrilus ruficollis Fabr.—A Buprestid beetle found in North America, which attacks blackberry, dewberry, and raspberry.

Bembecia marginata Harris and *Bembecia hylaeiformis* Lasp.—The larvæ of these moths attack the crowns by the formation of galls. They will attack raspberry as well as blackberry.

(2) *Insects attacking Twigs.*

Diastrophus rubi Htg.—A small gall-forming Cynipid which favours the same hosts as *Agrilus ruficollis.*

(3) *Insects attacking Leaves and Shoots.*

Thyatira batis Linn.—Attacks both blackberry and raspberry. Its only damage is that caused by the larvæ feeding on the leaves.

Habrosyne derasa Linn.—Feeds, as in the case of the preceding, on both blackberry and raspberry, but only to a very slight extent on the latter.

Cidaria albicillata Linn.—Has a number of hosts, the most noticeable damage being the larval attack on the leaves.

Tischeria marginea H. W.—A leaf-miner which has been reported to attack blackberry and many other plants.

Notocelia uddmanniana Linn.—The larvæ of this cause rolling of the leaves of blackberry and raspberry.

Schreckensteinia festaliella Hb.—A leaf-feeding Tineoid.

Typhlocyba tenerrima H. S.—This small European leaf-hopper is not known to feed on any plant other than blackberry.

Monophadnoides rubi Harris.—A North American sawfly which attacks both blackberry and raspberry.

Metallus rubi Forbes.—Also a North American sawfly which mines the leaves of blackberry only.

(4) *Insects attacking Flowers and Fruit.*

"I have not been able to find any insect so far which is effective in these parts on the blackberry. Various species of *Byturus* attack the fleshy receptacle of the fruit of species of *Rubus*, but they all seem to prefer the raspberry to the blackberry, and in any case they do not prevent seeding, but only make the fruit unpleasant to eat.

"The Anthomyiid fly, *Phorbia rubivora* Coq., known in America as the raspberry-cane maggot, is very deadly on raspberries, and prefers them to blackberries. There may be other species of this genus which will only attack blackberry, but I have no record of them so far.

"The blackberry-fly, *Petrandrus rubivorus* Coq., found in South Africa, is stated to never attack raspberry or any other fruit."

Of the above species provisional permits were granted for the introduction of the following: *Coroebus rubi*, *Agrilus rubicollis*, *Bembecia marginata*, *Bembecia hylaeiformis*, *Diastrophus rubi*, *Thyatira batis*, *Tischeria marginea*, *Notocelia uddmanniana*, *Schreckensteinia festaliella*, *Typhlocyba tenerrima*, *Monophadnoides rubi*, and *Metallus rubi*.

Habrosyne derasa, *Cidaria albicillata*, and *Typhlocyba tenerrima* have been collected and left at Rothamsted, in England, for close study.

By March, 1927, eleven small insectaries, six being for this special work, were in commission at Cawthron Institute. They were very carefully constructed to ensure the proper and safe keeping of the insects for experimental work. Later in the same year Dr. Tillyard designed a new insectary, 50 ft. by 42·5 ft., costing about £2,000, and to be used mainly for work on blackberry. It was brought into use towards the end of the year. The whole scheme has been assisted by financial support from the Empire Marketing Board and the New Zealand Government.

METHODS OF TESTING PARASITES.

The three generally accepted methods for the proper testing of insects used for the control of noxious weeds are as follows: (1) Oviposition, (2) starvation tests, (3) preference tests. In the case of the insects introduced into New Zealand for the control of noxious weeds these three tests are being carefully carried out under the best and safest experimental conditions possible.

(1) *Oviposition Tests.*

Fertile females are tested in closed cages with portions of the plant on which oviposition is required, and it may be found that (*a*) oviposition takes place on the plant ; (*b*) the insect refuses to oviposit on the plant, but oviposition takes place somewhere else in the cage ; (*c*) the insect refuses to oviposit.

(2) *Starvation Tests.*

These tests are carried out on the larvæ and adults of all phytophagous insects, and consist of confining them with the plant alone ; consequently they have to eat it or starve.

If in oviposition tests eggs have been laid on the plant, then these are allowed to hatch *in situ* ; if they are not fertile, then fertile eggs are placed on the plant. Where the larvæ and not the eggs are being used for transference they are selected from their natural food plant and placed on the plant under investigation, the insects being tested in the four following stages : (*a*) First larval instar, newly hatched ; (*b*) half-grown larvæ ; (*c*) beginning of last larval instar ; (*d*) imago when necessary.

These tests may result in any of the following : (*a*) Feeding on the plant ; (*b*) feeding, but without vigorous attack ; (*c*) feeding, followed by death ; (*d*) refusal to feed and consequent starvation.

(3) *Preference Tests.*

These are used to show to what extent an insect favours a certain plant. Under starvation tests it is determined whether the insect is positive or negative to a large number of closely related plants, while under preference tests the degree to which each of these plants may be parasitized in the presence of others is readily determined. For instance, blackberry may be the natural food plant of a certain insect, but it is necessary to determine to what extent loganberry may be parasitized. A number of insects are placed on loganberry which has been proved positive, and then blackberry is introduced into the same cage. The following results may be obtained : The insects may persist on loganberry and not attack blackberry at all ; a certain number may go over to blackberry, the rest remaining on loganberry ; or they may all leave loganberry and commence feeding on blackberry.

PARASITES RECEIVED AND RECENT OPERATIONS.

Early in 1927 the following insects were received for the Institute : (1) *Thyatira batis* Linn., (2) *Agrilus ruficollis* Fabr., (3) *Bembecia marginata* Harris, (4) *Coroebus rubi* Linn.

Seventy-eight pupæ of *Thyatira batis* were received, and fifty-two of these emerged, twenty-two being males and thirty females. The moths were placed in egg-laying cages, and 340 larvæ resulted. These, on account of very heavy mortality and starvation tests, were reduced to sixty-four. The starvation tests showed that they were positive towards raspberry and loganberry, but negative to strawberry. Preference tests were also carried out, resulting in the following : (*a*) Raspberry *versus* blackberry—All larvæ returned to blackberry, showing a very strong preference for it. (*b*) Loganberry *versus* blackberry—The larvæ again returned to blackberry.

Dr. L. D. Howard, of Washington, sent blackberry-canes with *Agrilus ruficollis* and *Bembecia marginata*. All the canes did not grow; those which survived showed two specimens of *Agrilus*, which commenced to feed on blackberry but did not survive. No specimens of *Bembecia* survived.

The most hopeful insect for the control of blackberry is *Coroebus rubi*. The larva of this bores down from the crown into the root and then returns to the crown, by which time it is fully fed. It then forms a large cavity within the tissues, where pupation occurs. This insect shows a great liking for *Rosa indica*, which, in Europe, is used as stock for many varieties. Exhaustive inquiries, however, have proved that it is seldom made use of in New Zealand. The following are commonly in use as stocks in this country: *Rosa canina* (dogrose) and *Rosa simplex* (*multiflora* or *poliantha*), mainly in the North Island; *Rosa laxa*, to a very small extent; *Rosa manetti*, to a great extent. Stocks of all these are now being grown so that *Coroebus rubi* might have a thorough test.

Unfortunately, at date of writing, all the imported specimens of this insect have failed, but a further supply is expected, and when these are received a very complete study is to be made of this parasite.

For information as to the progress of this work at the Cawthron Institute I am indebted to Dr. Tillyard, who kindly placed his reports on the subject at my disposal.

General.

With such a formidable list of insects, exhibiting such a variety of methods of attack, the biological control of blackberry may be regarded as distinctly encouraging. There are several points worthy of comment: Firstly, it is not likely that a parasite can be found which selects blackberry exclusively for its host; secondly, all the insects which attack blackberry (*Rubus fruticosus* Linn.) also parasitize the very closely related raspberry (*Rubus idaeus*); thirdly, the range of hosts, as far as is known, in the natural habitat, appears very limited—few hosts being outside the genus *Rubus*. If an insect or a collection of insects, or the combination of an insect and fungus, could be found to eradicate or control blackberry at the expense of raspberry, it would seem reasonable to sacrifice the latter; for it is hard to see that the loss of the small raspberry industry can in any degree be compared with the tremendous yearly loss caused to the country by the ever-recurring necessity for clearing roadsides and drains of blackberry, and attempting to prevent its further spread, together with the loss of good farming-land already rendered useless by blackberry infestation. Probably the cost to the country of the first of these items is far greater than the value of the whole of the raspberry crop for the Dominion.

Moreover, it must be pointed out that the insects likely to cause damage to blackberry and which also attack raspberry are comparatively easy to control. In the case of the gall-formers the infected canes can be cut out; while with the others a spray, applied sufficiently early to leave the fruit undamaged or without any adherent poison, should effect control.

It is interesting to note that up to the present insects have been found which attack the crown, the vines, the leaves, and the young shoots of blackberry, but no insect has been reported which feeds on the

flowers and young fruit. Hence, unless further investigation reveals such a parasite, if all else in the way of control fails, we cannot hope to prevent spread by biological means. Attack on the leaves and young shoots is an important point, for in this way the food-supply can be stopped and so in time the plant will become weaker and weaker; but the most reasonably hopeful parasite is the one which attacks the crown, for attack on this point is likely to more greatly damage, if not kill, the plant than at any other point. Attack above the crown cannot give much hope of rapid or effective eradication, though it would be a means of control.

A NEW PERCH FOR POULTRY-HOUSES.

L. W. C. COCKER, Poultry Instructor, Wellington.

THE object of this article is to bring under notice of poultry-keepers —on commercial plants in particular—a new method of supporting perches in poultry-houses. At present several styles of perch are in common use—for example, those suspended by wire catches, fencing-wire, or dog-chains, or those slotted into pipes let into dropping-boards and concrete floors. To a greater or lesser extent all are useful for the purpose intended, but some objections apply to them all.

The adoption of this new perch here described involves the discarding of the dropping-board. As regards this board, while it can be considered quite a satisfactory device when cleaned every morning, should it be left with accumulated droppings it becomes very insanitary and objectionable. The labour entailed in cleaning on large commercial plants is a big consideration, which has drawn attention to the desirability of devising some means of lessening the costs in this direction. Moreover, with this and the other systems of perching mentioned, features calling for consideration are practicability, efficiency, and convenience when cleaning or culling operations are being carried out. The floor-space covered by the dropping-board, even when the board is 1 ft. 6 in. from the floor, is not used to its fullest extent, because the active bird searching for food in the litter always works with its head to the light. Thus the straw is thrown towards the rear of the house, with the result that the litter accumulates there in a heap unless, of course, frequently attended to. In any case observation will show that the birds, even when all conditions are favourable, do not make as much use of the space as they would were the house free from obstruction.

Perches and similar furnishings of the fowlhouse which are not readily removable form an obstacle to efficient service in selecting stock. This is chiefly for the reason that as soon as disturbed the tendency is for the birds to congregate in the rear part of the house, the consequence being that they have to be continually stirred up in the search for the best specimens. With a clear floor the birds are in view practically the whole time, and the matter of selection is far easier.

In the perch illustrated it will be seen that an endeavour has been made to adopt the advantages and eliminate the disadvantages of the

FIG. 1.—THE NEW PERCH IN POSITION FOR ROOSTING.

FIG. 2.—THE PERCH FOLDED UP AGAINST BACK WALL.

[*Photos by H. Drake.*

various systems hitherto in general use. In the first place, it is of primary importance that the perch shall be as insect-proof as possible. This is provided for in that the perch-bracket is made entirely of metal (iron). Secondly, when culling the flock or cleaning the floor the perch may be folded up against the wall. This is an added facility in that the perches need not be removed in the event of the house being required for use as a storeroom, which is often the case in connection with the stove brooder and young-stock house. This point should commend itself to all rearers of first-class stock for breeding purposes,

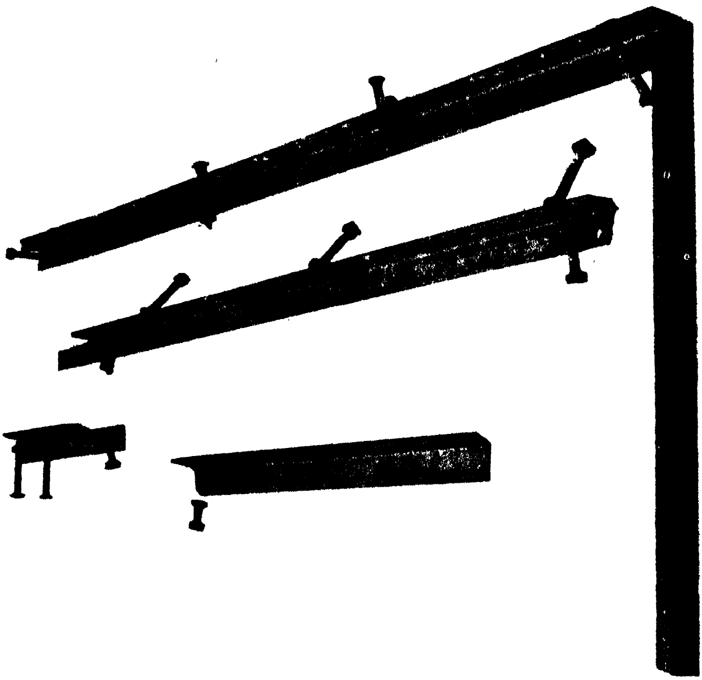

FIG. 3.—SHOWING THE PERCH SUPPORT ALONE.

Above—bolted together for fixing to back stud ; below—dismembered, with requisite bolts and nuts at respective positions.

who realize the value of ample exercise and fresh air, also sunlight and shade, for growing stock. Thirdly, when the perch is folded up in the daytime there is no inducement for the birds to roost instead of leading an active life by scratching litter. In the rearing of young cockerels, roosting by day is one of the difficulties to be contended with. Further, in folding up the perch during the day one not only eliminates the perching habit, but also one of the causes of that very common trouble, crooked breast-bone.

Some doubts may arise as to the wisdom of a perching system which does not provide dropping-boards, but it will be found that the

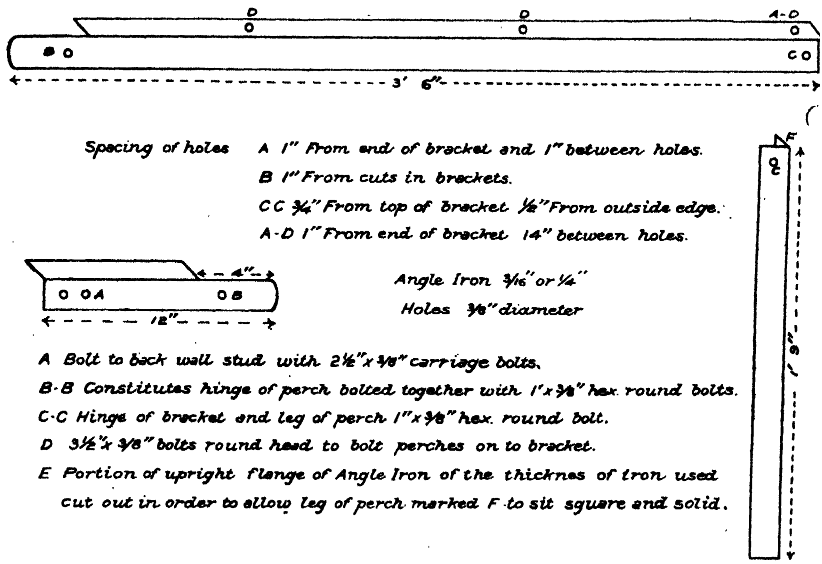

FIG. 4.—DETAILS AND DIMENSIONS OF PERCH SUPPORT.

droppings cause no trouble so long as the litter and floor of the house are kept dry. Actual experience has shown that no smell other than a slight aroma of ammonia is perceived. The litter, however, should be frequently stirred up, and a little fresh straw added at intervals when required.

In the course of time the action of the moisture in the droppings, together with the constant scratching of the birds, will cause the litter to become disintegrated and worked into fine particles, when it is most valuable as a dressing for either pastures or gardens. As a rule, where these conditions are complied with, it is unnecessary to clean the house more than once or twice during the course of the year.

These new perch supports can be made by any handy man equipped with a boring outfit, hacksaw, and vice. Either $\frac{3}{16}$ in. or $\frac{1}{4}$ in. angle-iron is suitable, and the necessary bolts and nuts can be purchased with the iron. The accompanying photographs give a good general idea of the device. They were taken at the Wallaceville Poultry Station, where this method has been introduced. The drawing supplies details of dimensions, &c.

PRICE OF STRYCHNINE FOR RABBIT-DESTRUCTION.

WITH reference to the sale of strychnine by the Live-stock Division for rabbit-poisoning purposes, farmers and others concerned are notified that the price for quantities of 100 oz. or more has been reduced to 2s. 6d. per ounce. The price for lesser quantities remains at 3s. per ounce.

SEASONAL NOTES.

THE FARM.

WINTER FALLOWING.

THE term "fallow" is derived from the Anglo-Saxon word "fealu," meaning yellowish-brown, and refers to ploughed ground left in an uncropped state. In medieval times the soil-fertility of arable land was maintained at a constant but rather low level chiefly by means of a summer and winter fallow. The arable land was divided into three fields, and the usual rotation was—winter wheat; barley, oats, or spring wheat; fallow. The summer fallow was the nitrate-accumulating one, while the winter fallow accumulated potash and phosphates. In modern agriculture, through the adoption of complete rotations and the use of artificial fertilizers, the summer and winter fallows have lost much of their importance as a means of making available plant-food in the soil. The fallows, however, are still of considerable importance as a means of regulating the amount of moisture held in the soil for the use of crops.

The practice of winter fallowing in New Zealand is chiefly confined to heavy land in sub-humid arable farming districts, when spring- and summer-sown root and forage crops follow a cereal. The land is ploughed in the late autumn or early winter and left in the unbroken furrow slices, so that the weathering agencies may have free play in breaking up clods, and in order to allow the winter rains to quickly pass through the top soil and enter the subsoil instead of running off the surface.

Root crops require enormous quantities of water. A 30-ton crop of mangolds, for instance, consumes about 1,500 tons; an inch of rain amounts to 100 tons per acre, so that at the yield stated 15 in. of rain would be required. The rainfall over a large part of the arable farming districts of Canterbury is about 25 in., and the normal rainfall from October to April is 14 in., which is insufficient for the crop, as only about one-third of the summer rains percolate through the soil, the rest being lost by evaporation. The root crops must thus draw upon the reserves of water held in the soil and subsoil. The months during which a large proportion of the rainfall may be stored in the subsoil are May to September, so that late autumn and early winter ploughing is essential for the production of good root crops. During May and June the teams on arable mixed farms are generally busy sowing winter wheat, but there are often periods when land can be ploughed, although the weather conditions are not suitable for cultivation work, and it is during these periods that heavy stubble land intended for root and forage crops should be ploughed if possible.

In the North Island root and forage crops usually follow grass, and the winter fallowing of grassland requires careful consideration. When grassland is ploughed in the autumn a skimmer attachment should be used on the plough, to turn part of the furrow slice to the bottom and so prevent grass growing between the furrow slices during the wet winter months. The winter fallowing of grassland containing twitch

is often disastrous; in many parts of the North Island pastures contain a good deal of brown-top, red-top, and Poa pratensis, and although these grasses may not be very noticeable in an old pasture before it is broken up they are rejuvenated by the ploughing, and grow vigorously during the winter when the land cannot be touched owing to wet weather. On light land red-top will often take possession of fallow ground in the winter, and brown-top often does the same on heavy land. Land on which these grasses are likely to be troublesome should never be winter-fallowed by skim-ploughing the grass in the autumn or early winter, but should be ploughed in August with a skimmer attachment on the plough, and kept worked up during the spring until the crop is sown.

WINTER FEEDING OF YOUNG STOCK.

The first winter is a critical period in the life of dairy cattle, and their subsequent development depends very largely on the feeding during this period. Calves should be the first stock on dairy farms to be given a ration of hay in the early winter. It is essential to get them used to hay and root feeding before the grass-growth seriously declines, because it is usually some time before calves will eat much hay, and if its feeding is left too late the animals often lose condition, which they will not pick up again. Besides adequate food, the calves should get an ample supply of pure water; dirty drinking-holes in drains are liable to lead to the young animals becoming affected with internal parasites.

Lambs to be kept over the winter should be well fed after weaning, so as to have them in good condition to stand the winter. Lambs affected with internal parasites should be drenched or given worm-tablets, kept on dry ground, and given frequent changes of pasture. In mixed-farming districts hoggets are frequently wintered on turnips, and care should be taken to see that they are doing well. At one year old the two centre milk-teeth are replaced by permanent teeth, and before this occurs the two milk-teeth become loose, the gums swollen, and the animal often has difficulty in eating the turnips properly. For this reason hoggets should be the first on the turnips, being thus allowed to graze the tops off. They are then followed by the fattening sheep, which clean up the tops of the bulbs, and they in turn are followed by the breeding-ewes after the shells have been lifted by the grubber. The hoggets in the meantime are placed on a fresh break of tops.

THE MANGOLD CROP.

A start should be made in pulling the mangold crop some time in May. Before feeding, the roots should be lifted and heaped to ripen. If fed while still growing or in an unripened state mangolds are liable to cause scouring, and many cases of tympany and abortion have occurred through feeding them green. When the crop is lifted the tops should be pulled off and left in the field, as they are of poor feeding-value, though they contain a considerable amount of fertilizing ingredients. The tops from an average crop of mangolds contain as much fertilizer as is contained in 4 cwt. to 5 cwt. of dried blood, 1½ cwt. of sulphate of potash, and 1 cwt. of superphosphate. In pulling mangolds care should be taken not to break the roots, or they will bleed.

The roots are preferably stored in a long heap under trees; if in the open, the top of the heap should be covered with straw to keep the frost off.

—*P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.*

THE ORCHARD.

LATE APPLES FOR EXPORT.

WHEN these notes appear the export of fruit will be drawing to a close, only the late varieties of apples remaining to be packed. Very little difficulty should be experienced with these, the colour question not having to be considered to such an extent as with some of the mid-season varieties. It is expected that a record crop of Sturmers will be exported this season, there being heavy crops in almost all districts. This variety is favoured on the overseas markets, and usually commands a good price; therefore every precaution should be taken to see that it arrives in good condition. The Sturmer is easily bruised, and although the bruises dry out, leaving a brown patch, the general appearance is affected. Remembering this fact, care should be taken in the handling right from the picking up to the time the fruit is placed on the overseas vessel. Packing can be slightly firmer than with some other varieties, although not so tight as to cause bruising in the cases. The regulations with regard to russet on this variety are very liberal, and there should be no difficulty in packing to the different grades. Of the other green varieties, Grannie Smith is probably the most important. Prices realized for this variety last season were very encouraging. It is a good carrier, and, like the Sturmer, is appreciated in Britain.

THE AUTUMN CLEAR-UP.

In many instances, especially where export is not carried on, all fruit will be gathered and disposed of by the end of this month, and attention should be directed to a general clean-up of the orchard before the usual winter work commences. Fruit-cases used in the handling of the crop should be collected, repaired where necessary, and stacked away for the following season. All diseased and cull fruit should be destroyed, thus reducing the chance of infection from this source to a minimum. Props used for supporting heavily laden branches in the orchard should be collected together, and stacked in a dry place for future use.

NEW PLANTING.

Where it is intended to plant new areas, the land can be prepared by thorough and deep cultivation, getting everything in readiness to receive the young trees. In some districts planting can be done in the autumn with advantage, thus giving the trees time to establish their roots during the winter and go straight ahead in the spring. Where the soil is inclined to be cold and wet, it is advisable to defer planting until the spring.

—*G. Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

To maintain a citrus-grove in good order and continued profit is a much more difficult proposition than the establishment of young citrus-trees. Planting is usually done in spring, and the climatic conditions from then on up to late autumn are generally ideal for the growth of the citrus-plant—warmth, equable conditions, with periodic rain—but for permanent maintenance trees have to be fostered, and in some localities even coaxed, through periods of the year when climatic and other conditions are far from natural for citrus-growth. With the advent of this unfavourable season it is well to consider some of the main detrimental conditions to be avoided.

Soil Moisture and Drainage.—Excess of moisture in the soil is annually responsible for more serious set-back to trees and more total loss than possibly any other cause. All the citrus tribe delight in warm soil-conditions, as evidenced by their habit of surface rooting. To allow the ground to remain waterlogged can only result in unfunctioning if not decaying roots, and if the tree is not lost it receives such a check as to take more than normal time to recover in the spring.

Citrus-culture is most successful in parts of the world where the water content of the soil is regulated by irrigation. While we cannot regulate the amount of rainfall, there are several cultural points which, strictly observed, will minimize undue moisture in the soil. Drainage is, of course, most necessary, and should be attended to even before the trees are planted; but it is quite possible that consolidation of the land has to some extent nullified the effect of what was once thought to be ample under-drainage, so it is well to make sure that sufficient drains have been installed, and that they are properly clean and in good working-order. If not, the defect should be corrected, otherwise the success of the whole is prejudiced. Surface water can be quite as damaging as waterlogged subsoil. Early winter regulation of the hard surface should therefore be so done as to avoid hollows, and the land between the trees left with a double open furrow to take away surplus surface water.

Shelter.—The very nature of citrus-trees predisposes them to damage from exposure, broken branches or limbs, partial defoliation, a general hardening of the bark, and a loss of vitality. The main object to achieve in order to minimize this is adequate shelter on the windward side. Where no shelter exists, this should be remedied during early winter, so that shelter-trees or hedge-plants may be well established and ready to grow in early spring. Many existing shelters thought to be sufficient prove on examination to be deficient in so far as the ragged lower parts and gaps are concerned. This may be remedied by the erection of brushwood breakwinds and the growth of interplanted hedge or shelter plants.

Frost.—Much annual damage by frost is perfectly obvious, but reduction of vigour and retarding of development in the trees is also considerable, though not so noticeable. Most damage is done to young growth, and at a variable minimum distance from ground-level. In areas subject to light frosts only the trees therefore grow beyond apparent damage in a few years, but in these first years all possible protection should be given. Many adult trees also suffer injury, mainly to young growth, particularly that made during the previous autumn.

Proper spacing of branches and laterals, and the avoidance of highly nitrogenous manures during late summer, will permit the wood to mature to a greater degree of frost-resistance.

Clearing Tree-trunks.—Owing to the amount of collar-rot and decayed bark caused through fresh manure or decaying litter being piled up round the bole of the trees, it is wise at this season to thoroughly clean up around the trunks. A mulch of general litter or manure may be very desirable during summer, but is more often injurious during winter.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

SYSTEMATIC MANAGEMENT.

The poultry-keeper who during recent weeks has acted on the principle of doing the right thing at the right time will now not only be well ahead in his work, but will also be working on sound lines. All surplus cockerels and hens which have passed their best period of production will have been marketed before this. Further, the best hens, and also the best of the cockerels reared, will have been selected and placed under special conditions, so that they may be in the best of nick for the forthcoming breeding season. The pullets will also be well settled down in their winter quarters under those favouring conditions which encourage the production of the much-desired winter eggs.

On plants where these important matters have been neglected till now there is no telling what loss it may mean in the long-run. For instance, with the great majority of the hens now moulting, it would be almost an impossible task to separate the likely future profit-makers and desirable breeding specimens from those that should have long since been culled. This being so, there will probably be retained in the flock many weak and non-paying types, while the worst loss of all will be experienced if any of the weak specimens are used in the breeding-pen—by the weak progeny which is almost sure to be produced. It should always be remembered that efficient culling and the selection of the most desirable breeding-hens can only be properly carried out before the moulting-period sets in, and those who have failed to do this will in all probability find it a costly mistake.

COLDS, DRAUGHTS, AND VENTILATION.

This is the time of the year for keeping a specially sharp watch for infectious diseases among poultry, especially diseases which have their origin in colds. Young birds are usually more susceptible to colds than adult stock. The most common symptoms of colds are sneezing, eyes watering, and a discharge from the nostrils, to which dust and dirt usually adhere. As soon as such signs are observed the affected birds should be promptly isolated. The next step should be to find the cause of the trouble and have it removed at once. There are so many things responsible for fowls catching cold that very often it is necessary to look for the cause in several quarters. Many poultry-keepers who have asked for advice in regard to colds have no idea as to their origin, and,

instead of trying to discover and if possible remove the cause, in most cases they look for one of the curative methods as the only safe course. The fact of their having the modern, deep, open-fronted, lean-to style of house leads them to believe that ideal conditions are being provided, and that a curative method is the one and only thing to resort to. This is all right in its way, but it should be remembered that the best style of house ever planned will not give entire satisfaction under varied local conditions. It is true that for practically any site and for prevailing local conditions the style of house described is the best arrangement yet evolved for providing shelter for the domesticated fowl ; but if the best results are to be obtained the poultry-keeper must be always on the alert to observe weaknesses in the system, and make modifications to suit his own local conditions.

To give an example : I was recently called upon to advise regarding a flock of pullets affected with colds. The house they were sheltered in had much to recommend it, and gave all the requirements for the comfort and well-being of the stock, with the exception of one vital point which constituted a serious weakness—it was not draught-proof. Thinking that the ventilation provided at the front of the house was insufficient, the owner of the plant had made an open space of 3 in. between the top of the back wall and the roof. The danger from the draught thus created was intensified by the back wall being rather low and the fact of the birds being made to perch at a considerable height from the floor, so that they were practically subject to the full force of the draught all the time they were on the perches, just when they required the most comfortable conditions. It was not surprising in these circumstances to find that the birds were badly affected by colds, bordering in some cases on roup.

The point should never be lost sight of that in constructing a house for feathered stock the maximum amount of comfort should be combined with the maximum supply of fresh air, while every precaution should be taken to prevent the birds sleeping in a direct draught. The slightest crevice or crack is apt to cause an outbreak of colds. A good way of ascertaining whether or not the birds are sleeping in a draught is to visit the house by night and hold a lighted match or candle along the walls where the birds are roosting. If indications are that a draught is present the matter should be corrected at once. While it is true that a slight crack in the back or side walls may give one bird a cold, it must be remembered that the germs from this one, chiefly through being left in the drinking-water, may soon cause the whole flock to become affected.

Reverting to the question of having an opening in both the front and back walls of the house as a means of providing plenty of ventilation, it is certainly true that some flocks will keep free from colds and remain in a perfectly healthy state when these conditions are present. In such cases, however, there is usually some favouring local condition to counteract a direct draught and its evil effects. The site may be a well-sheltered one, where mild climatic conditions prevail, or the back wall may be sufficiently high and the perches at a low level, the birds not being subjected to the full force of the draught created. Where these and other factors are not present the question of having a ventilation-space at both back and front, and at all times, should be viewed

with caution. Especially is this the case when bad weather is being experienced. The principle of having ventilation-space at the back of the modern fowlhouse is perhaps carried out at its best when the opening is arranged in such a way that it can be closed or opened in accordance with prevailing weather conditions. In a general way, of course, especially during fine weather, there would be no objection to having an open space at the back of the house during the day. It is in compelling a bird to sleep in a draught that the chief danger lies.

POINTS IN HOUSE-CONSTRUCTION.

Some poultry-keepers have very long houses, and wire netting only is used between the compartments. This is a mistake, unless, of course, the site is particularly well sheltered, as a strong wind having nothing to break its force is apt to cause discomfort to the birds. On most plants it will pay well to have the partitions dividing the house made of some airtight material, such as asbestos-slate, beaver-board, &c. If the partition is to have the desired effect it should stretch the full width of the house, and not merely a few feet from the back wall. Where boards are used for the intersecting walls it is very important that there be no cracks for the draught to come through, otherwise colds and roup will soon appear. Indeed, in the many cases where I have been called upon to advise regarding troubles having their origin in colds, the greatest number could be traced to the intersecting walls not being draught-proof. For preventing draughts in a wooden dividing-wall it is a good plan to cover the latter with some airtight material, such as cheap roofing-material, &c.

The question of how much of the front of the house should be left open to provide ventilation is a matter that can be decided only according to the prevailing local conditions. Generally a space of 3 ft. is allowed, but experience goes to prove that where the plant is located on a bleak situation this amount must be reduced if colds are to be prevented. Good ventilation is an essential requirement for feathered stock of all ages, but it can be easily overdone, especially with the artificially produced young bird. This does not mean that the birds should be coddled, but rather that a sane course should be steered between too much ventilation and insufficient ventilation. Poorly ventilated quarters should always be guarded against, as in these the birds become overheated by night, making them susceptible to chill when they go outside in the morning. Then again, in order to resist colds the birds must not be overcrowded. Above all things, the quarters must be kept in an absolutely sanitary state.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

UNITING COLONIES.

THE presence of weak hives in the apiary must be avoided as far as possible. During warm autumn days these colonies rarely escape the attention of robber bees, and are easily molested. When once they are attacked the beekeeper will find it extremely difficult to save them, and eventually they will get robbed out despite his efforts. It is far

the better plan to unite the bees with a stronger colony than to run the risk of unsettling them in the dormant season through the encouragement of wholesale robbing.

COVERS.

With the approach of the rainy season it is advisable to make a complete examination of the hive-covers in use. Altogether too little attention is paid to making the covers watertight, and neglect in this direction lead to winter losses. No amount of labour should be spared in saving the bees from exposure and dampness, and by so doing warding off the large annual losses that occur through neglect. There is no excuse for the beekeeper neglecting to protect his bees, and he will find in the long-run that a small expenditure on some suitable waterproof roofing-material will doubly repay him, and will be the means of saving colonies that would otherwise be lost. Bees must be kept dry. An examination made of colonies where proper protection is not provided will reveal the presence of large quantities of propolis. Usually this is collected to prevent the penetration of external moisture, and it is noticeable that it is gathered freely in the autumn months. Where adequate protection is provided the bees are to a large extent saved the labour of collecting the propolis, and by providing dry roofs the beekeeper is assisting them. In the case of roofs that are cracked, do not attempt to tinker with them, but cover entirely with some waterproof material. In the long-run metal coverings are the cheapest and the best. Good zinc or galvanized iron makes ideal covering, and will last for years.

SPARE SUPERS.

Where extracted combs have been placed on the hives for the bees to clean up, these should be removed and the bees confined to as small a space as possible consistent with the size of the colony. It may be necessary to leave some of the supers on during the winter months, and these can be dealt with in the spring. Do not leave the bees more space than they require, as it will be found that they will desert the lower supers and cluster at the top for warmth.

MATS.

It should be seen that each colony is provided with one or two good mats during the winter months, to keep the bees as warm as possible. Mats should be cut to fit exactly on top of the frames, and may be made from clean sacking or canvas. Sugar-bags or cornsacks make excellent mats and are easily procured. Wood mats are adopted by some beekeepers, and, if desired, may be secured at a moderate cost from dealers in bee material. In districts where the bees do not bring in a great deal of propolis wood mats are effectual. On no account use calico mats, as these afford practically no warmth.

WEEDS.

The hives should be kept clear of all weeds, so that the flying bees may have free access to the entrances. Many bees are lost by striking growing obstacles on returning to the hives For the next few months, when the air is charged with moisture, it is important that plenty of air and as much sunlight as possible should penetrate beneath the bottom-boards. In damp situations place the hives sufficiently high

from the ground to avoid the dampness. Old bricks or concrete blocks make good supports for the bottom-boards. Make sure that the hives have sufficient cant towards the front before the winter rains set in. The presence of much moisture on the bottom-boards will be the means of loss to the beekeeper, and, in addition, cause the hives to become sour and foul-smelling.

CARE OF COMBS.

Good extracting-combs are the most valuable asset the beekeeper possesses next to his bees, and great care should be taken to secure them from the ravages of the wax-moth and mice. Hundreds of combs are destroyed annually through carelessness, and this can be prevented by attention to small details. Mice destroy the combs to gain access to the pollen and honey, and render the best combs foul and distasteful to the bees. Combs can be stacked in a mouse-proof room or in supers tiered one above the other. Queen-excluders may be utilized to keep mice out of the combs, and in the absence of close-fitting roofs are a complete success. If the presence of the wax-moth is detected the tiers of combs should be fumigated. Bisulphide of carbon is effective in destroying insect-life, but should be used with great care, as it is highly inflammable. Prevention is better than cure, and a few moth-balls placed in the supers will prevent attack of the moths.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

GREEN COVER-CROPS.

MOST of the land devoted to horticultural crops is under continuous cultivation, and requires careful nursing if its fertility is to be maintained. In the absence of stable manure, which has been relied upon chiefly for this purpose, the modern substitute is to grow a green crop and plough it in when it matures. Where chemical manures have been used freely during the summer a further application will not be needed now, but otherwise a moderate dressing should be applied when sowing, to stimulate the growth of the cover-crop. Hardy crops that will grow freely at this season are oats, tares, barley, horse-beans, and white mustard. A fairly heavy sowing should be made ; it will smother the weeds and prevent the leaching-out of nitrates that would otherwise take place.

WINTER DRESSINGS OF ORGANIC MANURES.

Although such supplies are scarce, what can be obtained from woolsheds, cow-yards, and fowlhouses, and even seaweed, will be of great service where the material has been properly fermented and partially decayed. It should be used freely on such crops as rhubarb and asparagus, and on land that is to be planted with early crops such as spring cabbage, cauliflower, spinach, lettuce, &c. The addition of 2 cwt. to 3 cwt. of superphosphate per acre should be made with this application.

The proper preparation of these materials is important ; if they are stacked in a compact heap and given some shelter from weather they will ferment, and all weed-seeds will sprout and be destroyed. The material is thus more readily available to the plants, and much trouble from weeds is avoided.

TRENCHING AND SUBSOILING.

After two or three years of constant ploughing or even digging the subsoil becomes compacted and hard in most soils; for that reason each year a portion should be given a deeper cultivation, more especially that area which is to be devoted to root crops. This may be done by double ploughing, or ploughing with a subsoil attachment. On smaller sections trenching may be done by turning over the top spit and breaking up the second, incorporating with the latter a liberal addition of organic manure or humus — an addition, however, which should be omitted where root crops are to follow immediately.

HEDGES AND DRAINS.

The proper care of hedges is peculiarly neglected in this country, where they are so valuable as shelter. In addition to unseasonable trimming they are usually cut so lightly that they become top-heavy and bare at the base, thus becoming weakened, inefficient, and covering much ground. The present time is suitable for trimming back most hedges. The sides should be cut hard back so that the hedge becomes narrow at the top. If the hedge is such as that above described, cut it well back on the one side this season, deferring the more drastic treatment on the other side for another year. This treatment admits the sunlight to the base, which will thicken up and give an improved appearance and efficiency.

We have been more concerned lately with a lack of moisture than a surplus, but the usual attention to drainage at this season should not be omitted. Early crops are always in demand, and for that a well-drained soil is indispensable. This may be secured by clearing now all culverts and open drains. Make a neat job of stacking the spoil; if it is not placed at the foot of a hedge, see that it is spread before it dries hard and becomes an unsightly obstruction.

EARLY SPRING CROPS.

Where, to avoid rust, lettuce seedlings for early planting are grown in frames they should be given air at all times, but during fine weather the sashes should be removed and the plants grown as hardy as possible.

On light, warm land the winter and early spring crops are often the main source of income. In such localities an early crop of peas may be obtained in some instances by sowing a dwarf early variety during the present month. Complete all planting out of spring cabbage and cauliflower and the blanching of celery.

STOREROOMS AND PITS.

Crops in storage will require careful attention for the first month or so, chiefly to avoid heating, a danger which threatens most where large bulks are stored in a comparatively small space or there is lack of proper ventilation. After that period surplus moisture will have dried off and the danger will be correspondingly reduced. Until then ventilate freely, especially in cold, dry weather. In a few instances there may be danger of freezing, but, of course, steps should be taken to avoid that risk.

—*W. C. Hyde, Horticulturist, Wellington.*

REVIEW.

EUCALYPTS IN NEW ZEALAND.

Trees from other Lands for Shelter and Timber in New Zealand: Eucalypts. By J. H. SIMMONDS. Quarto, xviii plus 164 pages, 76 botanic plates, and 28 scenic plates. (Brett Printing and Publishing Company, Auckland; £2 10s.)

IT is certainly not an exaggeration to assert that no one except its enthusiastic author—the Rev. J. H. Simmonds—could have produced this truly notable book, the first of its kind in this country, for its author year by year for many years has been fitting himself for the task. He has cultivated many kinds of *Eucalyptus*: he has studied in all parts of New Zealand the behaviour of the different species in cultivation; he has seen many growing in their natural habitats in Australia and Tasmania; he has examined the herbaria from which much information concerning their classification has been derived; and he has dived deep into the literature of his subject. These many-sided studies have produced a many-sided work in which most aspects of the subject, both practical and scientific (but can the two be disunited?), are discussed in plain terms and in vigorous English.

First of all must come here the essential matter of classification. Up to the welcome appearance of this book the knowledge of the cultivated species of *Eucalyptus* in New Zealand has been based on a quite insecure foundation. In no few cases one and the same group of plants has been known by different names—possibly none of them the right one—or groups distinct enough from one another have borne one and the same name! This sorry state of affairs, if Simmonds's book is followed, should before long be a thing of the past, since not only is there a good description of each of the seventy species cultivated in this country, but there is an authentic, life-size picture of each from the hands of those qualified botanical artists, Misses Flockton and King, who prepared the plates for Maiden's classical monograph on *Eucalyptus*. Thus exact figures of the types of those species which are grown in New Zealand are available for all who wish to find out the correct name of any eucalypt they want to identify. Certainly in the matter of the nomenclature of *Eucalyptus* there still remains much to be done in Australia, in the field rather than in the herbarium, especially in the way of finding out the true-breeding groups of individuals, the effect of environment, and, above all, the occurrence of wild hybrids, which must certainly be present, and probably in great abundance. The author himself embodies in other words similar ideas when he writes: "They of to-morrow will discern in those trees origins and kinships that are still hidden from our eyes. From this growing knowledge there will gradually emerge for the Eucalypts a classification upon which nature herself will place the seal of approval." Also, those who read between his lines will see that for practical purposes the author considers it is not safe to admit to cultivation a species on its name alone, but rather it is the best *strain* of the "species" which is wanted. Thus the author's philosophy concerning species is much the same as that of the reviewer, in that the species is frequently merely an abstraction, not a reality (*e.g.*, *E. amygdalina*), the realities being the true-breeding strains, or "jordanons" as they are now called by some.

The botanical plates are not the only illustrations of moment in the book. On the contrary, there are many of particular value illustrating the admirable results of intelligent tree-planting on large estates or in beautifying the surroundings of the home. They are, indeed, a striking example to be followed by those—far too great a majority—who ignore the aesthetic and whose land stands naked. Nor is such planting of no monetary value, direct or indirect, but quite the contrary, as the author conclusively proves.

What may be called the "Simmonds general classification" of the eucalypts is quite novel, but from the standpoint of utility the only classification of real moment. It is based on climate, with the frost-tolerating capacity of the species

coming first. This leads to the division into six groups of the seventy species of *Eucalyptus* cultivated in this country, commencing with those the least hardy (tolerators of virtually no frost) and ending with the most hardy (tolerators of a considerable amount of frost). Thus the landowner who wishes to plant, if he is properly acquainted with the climate of his neighbourhood, with the aid of the book under review can tell pretty well for certain which species will succeed with him and which he should avoid. Where particularly frosty he has a choice of only seven species, but where the frosts are not nearly so heavy (20°–26° F.), and the summer comparatively hot, twenty species may be cultivated.

Scientifically the Simmonds classification is sound, and it might quite well be correlated with the presence of various indigenous trees in any area: *i.e.*, the different natural forest areas of New Zealand might most likely each be an indicator of what exotic trees could be successfully introduced. Or, taking a rather wider view, the various botanical districts might serve as the basis for the tree-planter, since each has its locally endemic plants, its particular plant-associations, its florula, and its climate.

For each of the author's divisions of his species, in addition to the trees being well illustrated and described, there is given for each species an account of its natural habitat in Australia or Tasmania and of its latitudinal, altitudinal, and ecological distribution in New Zealand. It is information of this class—quite new except in a general way—which stamps the work as of particular value, such information having been acquired only by extended travel and careful observation. Also, the relative importance of each tree from the standpoint of its timber is considered. In short, the remarks concerning each species supply indispensable information in many directions—information which cannot be neglected by the botanist, the forester, the gardener, or the landowner.

There are many other matters dealt with in this exhaustive work—*e.g.*, cultivation for timber-production; prevention of fire; harvesting the crop; natural spreading of trees—nine species thus established are cited; the preservative treatment of wood; and popular and scientific names, with, rightly, a strong bias for the latter; but the book is full of information, and all is put forth in simple but powerful language.

That the book is a work of great merit no one can deny. That it must play a notable part in the forestry and tree-horticulture of New Zealand should stand self-evident. But to accomplish fully its splendid purpose it must be properly in the hands of the public and before their eyes. Every library in this country worthy of the name should have a copy of Simmonds's Eucalypts. It should be in every high school and every technical college. Nor is the book one for New Zealand alone. *Eucalypti* are grown extensively in the warm temperate zone throughout the globe. To the cultivators of these noble trees the world over Simmonds's work should appeal.

L. COCKAYNE.

INTERNATIONAL INSTITUTE OF AGRICULTURE PERIODICALS.

As the result of an arrangement with the International Institute of Agriculture, Rome, subscribers to this *Journal* may obtain the following periodicals of the Institute at a 10-per-cent. reduction on the ordinary subscription rates: (1) *The International Review of Agriculture,* which contains about 130 pages, and is published in English, German, French, Spanish, and Italian editions; reduced subscription for each edition, 17s. 6d. (2) *The International Crop Report and Agricultural Statistics,* published monthly in numbers each containing about 50 pages, and in English and French editions; reduced annual subscription for either edition, 9s. The combined subscription for both publications is 24s. 6d. Orders (with subscription) should be sent either direct to the International Institute of Agriculture (Publications Department), Villa Umberto, Rome, Italy, or to the Publisher, Department of Agriculture, Wellington, New Zealand.

PRESENT SEASON'S PEDIGREE JERSEY HEIFERS AT RUAKURA STATE FARM.

These 18-months-old heifers have been mated to the stud bull Holly Oak Beauty Knight.

[*Photo by H Drake.*

WEATHER RECORDS: MARCH, 1928.

Dominion Meteorological Office.

THE dry weather which commenced about 20th December, and from which only partial relief was experienced in February, continued in many districts throughout March. Unfortunately, too, it has been most marked in some parts which suffered most in previous months—namely, Nelson, Taranaki, and the western portions of Wellington Province. Over the greater part of the Auckland Peninsula and in Hawke's Bay falls were above normal in March. In Canterbury and Otago, also, there were some cases in which the average was exceeded, and, in general, the deficiencies were not very serious in those provinces. Temperatures were, on the whole, mild.

The relative absence of westerly winds is still a characteristic of the season, while, on the other hand, the rate at which pressure systems move from the westward has remained rapid. The zone of prevailing westerlies appears, however, to be gradually pushing its way northward over the southern portions of the Dominion. The westerly type of weather ruled, indeed, from the 23rd to the 28th, but pressure was high to the north of the Dominion and the westerly rains practically did not extend north of Westland.

There were only two storms of any importance during the month. A cyclone of considerable intensity appeared north of the Dominion on the 5th, and, moving southwards, was centred near Auckland on the afternoon of the 6th. A secondary developed west of Kawhia during the 7th, and did not finally disappear till the 9th. Strong winds, mainly from a south-easterly direction, were experienced northwards of Cook Strait during the 5th and 6th, gale force being reached in places. Widespread rains fell in connection with this storm, but the western districts south of Auckland benefited little. There were some heavy falls northward of Castlepoint, but more especially in North Auckland. A cyclone of the same type was evidently centred to the north-east on the 14th to the 16th, causing fresh south-easterlies and rain north of Auckland and Castlepoint. Its centre, however, never approached very near the Dominion.

The second of the storms referred to was a cyclone which moved rapidly during the 25th to 26th past the south end of the Dominion. Strong westerly winds, reaching gale force at times in the Cook Strait region and southern Otago, blew on the 26th and 27th, while there was a strong westerly gale at Chatham Island on the 28th. The rains were again fairly widespread, but beneficial chiefly to southern portions of the South Island. A somewhat similar depression passed on the 30th, but this time its centre was farther south, and southern Otago was the only district greatly affected. Apart from the storms mentioned, depressions were mainly slight waves and the rain of a local nature. Waves passed on the 4th, 10th, 15th, 23rd, and 24th.

Anticyclone centres crossed some part of New Zealand on the 3rd, 14th, 17th, 29th, and 31st. That of the 17th was intense, and was almost stationary east of Otago until the 21st, when it decreased in intensity, disappearing finally on the 22nd.

The mild conditions, with lack of drying winds, have been favourable offsets to the lack of rain in the districts affected.

RAINFALL FOR MARCH, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	4·74	7	2·00	3·58
2	Russell	4·18	9	1·38	3·13
3	Whangarei	6·18	10	3·24	4·52
4	Auckland	3·45	11	1·53	3·03
5	Hamilton	3·00	13	0·74	3·88
6	Kawhia	2·40	9	0·62	3·43
7	New Plymouth	1·14	5	0·54	3·62

RAINFALL FOR MARCH, 1928—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
	North Island—continued.				
		Inches.		Inches.	Inches.
8	Riversdale, Inglewood ..	3·22	8	1·07	7·39
9	Whangamomona	2·01	7	0·70	5·61
10	Eltham	1·85	7	0·82	4·68
11	Tairua	4·38	10	1·78	5·92
12	Tauranga	3·72	10	2·00	4·16
13	Maraehako Station, Opotiki	4·10	12	1·50	4·09
14	Gisborne	8·63	15	2·20	4·51
15	Taupo	2·09	4	1·20	3·25
16	Napier	4·05	16	1·17	3·29
17	Maraekakaho Stn., Hastings	5·33	14	2·24	3·10
18	Taihape	1·13	7	0·53	2·95
19	Masterton	2·10	14	0·41	3·15
20	Patea	1·53	4	0·90	3·62
21	Wanganui	1·24	5	0·52	2·62
22	Foxton	0·48	3	0·34	2·20
23	Wellington (Karori reservoir)	2·13	12	0·76	3·48
	South Island.				
24	Westport	2·39	11	0·56	5·80
25	Greymouth	6·34	12	2·41	8·70
26	Hokitika	8·23	10	3·04	9·70
27	Ross	8·26	8	2·98	10·35
28	Arthur's Pass	6·39	5	2·40	9·74
29	Okuru, Westland	12·34	8	4·30	15·48
30	Collingwood	0·86	8	0·33	4·19
31	Nelson	0·22	4	0·16	3·08
32	Spring Creek, Blenheim ..	1·92	7	1·00	2·16
33	Tophouse	2·42	6	0·63	4·33
34	Hanmer Springs	5·03	8	1·11	2·89
35	Highfield, Waiau	3·52	8	1·04	3·00
36	Gore Bay	4·07	11	0·98	2·29
37	Christchurch	1·11	9	0·39	2·05
38	Timaru	1·94	10	0·64	2·31
39	Lambrook Station, Fairlie ..	1·42	5	0·64	2·47
40	Benmore Station, Clearburn	1·66	9	0·58	2·69
41	Oamaru	2·46	8	0·98	1·73
42	Queenstown	2·52	7	0·94	2·60
43	Clyde	1·30	8	0·40	1·50
44	Dunedin	2·20	12	1·28	2·08
45	Wendon	1·49	8	0·31	2·68
46	Gore	1·19	17	0·28	3·27
47	Invercargill	2·64	17	0·84	3·90
48	Puysegur Point	6·21	15	1·30	8·00
49	Half-moon Bay, Stewart Island	6·16	14	1·76	5·79

Phormium Industry Investigations.—" Valuable work at present is being continued into problems of the phormium industry," stated the Acting-Chairman of the Research Council at its February meeting. " During the flowering period Dr. J. S. Yeates has pushed on with his researches into the characters of the various strains of phormium and the crossing of various varieties. Mr. P. W. Aitken is investigating further bleaching processes, and is elaborating other methods devised by him for the practical treatment of larger quantities of fibre on a commercial basis. Steps are also being taken to devise a system of fibre-strength tests so that valuable information may be readily secured upon the strength of different fibres and the influence that various processes exert upon this strength."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

IODINE IN SHEEP'S DIET.

"BREEDER," Masterton :—

Can you tell me what is the best method of supplying iodine in a sheep's diet. I am quite convinced that some of my paddocks are deficient in iodine, more particularly since reading the article on feeding of live-stock by Mr. McLinden in the January number of the *Journal*.

The Live-stock Division :—

A simple and yet efficient means to employ if stock are grazing only is an iodized salt lick placed in suitable weather-protected boxes in the paddocks. If stock are being fed on meals it is preferable to administer the iodized salt by mixing it thoroughly with the meal at the rate of almost ¼ oz. per head per day. Iodized salt is prepared by taking 100 lb. of ordinary salt and drying it as thoroughly as possible by roasting. When dried, spread it out in a thin layer and sprinkle evenly with 4 oz. of potassium iodide which has previously been dissolved in a cupful of lukewarm water. Store in a dry place. It would be helpful to departmental work if a few untreated control sheep could be kept, when any difference due to iodine treatment could be noted, if resulting. A few of the points on which information would be appreciated are as follows: (1) Effect on wool quality, (2) effect on weight of clip, (3) rate of growth, (4) fecundity, (5) abortion, (6) sterility, (7) effect on size of the new-born.

HEDGEHOGS FOR ORCHARD.

M. N., Kawakawa :—

I have an idea of introducing hedgehogs into my orchard of 5 acres. There is a shelter-belt always within 200 ft. of any part, and there will be plenty of grass and rubbish among the trees until ploughing begins in spring. Therefore I think there should be ample shelter, while slugs, snails, crickets, woodlice, and cicadas are in plenty. Do hedgehogs eat fruit? Would they eat an apple to get at the moth-grub, and so help control? How about sprayed fallen fruit poisoning them? Do they climb or burrow? Wild cats and rats are in the bush, and my dogs about the orchard with me, but I suppose they can protect themselves.

The Horticulture Division :—

Hedgehogs are now plentiful in most of the closely settled districts of the Dominion. They hibernate during the colder months, but on mild nights they are active and will come out and tackle almost anything that is edible. Their partiality for birds' eggs has given them rather a bad reputation with some people. They would eat an apple, not necessarily for the grub; but they are small, with corresponding appetites. The orchard sprays would not be strong enough to hurt them. They live in the leaves and litter found in a hedge or plantation. They neither climb nor burrow, and find their spines a pretty good protection when attacked by dogs and other animals.

HONEYDEW ON BIRCH-TREES.

H. M. SANDERS, Kopua :—

Is there any remedial treatment for silver-birch trees which are blighted with what is commonly called "honeydew"? The branches become black and the leaves are coated with a sticky substance, and in a short time nearly all the leaves drop off. When the blight is at its height the trees are covered with flies.

The Horticulture Division :—

The honeydew secreted on the leaves and branches of your birch-trees is due to aphids or to scale insects. These sucking insects are often found on various trees in large colonies, feeding on the sap, and exude the sticky product referred to. Bees and flies gather and feed on the excretions of these insects. The honeydew acts as an excellent medium for the growth of a sooty mould, forming a black film which gives an unsightly appearance to the trees. The aphis can be readily controlled by a spray consisting of Black Leaf 40 (1 part in 800 of water). If the trouble is caused by scale insects, then an application of red-oil emulsion should be given (1 part to 50 of water). An orchard power-pump would be necessary to reach the upper parts of the trees.

TRANSIT OF EGG SETTINGS.

B. COTTERELL, Middlemarch :—

Please inform me if the transport of eggs for hatching purposes over a long distance—say, from Wellington to this district—in the course of which they would get a good deal of handling, would be likely to affect them in any way.

The Chief Poultry Instructor :—

Providing eggs are properly packed and not subjected to rough handling during transit they may be carried safely from the North to the South Island without their hatching-qualities being affected to any great extent. Usually, however, with the ordinary means of transit, there is a risk of the eggs receiving rough treatment and the hatching-qualities becoming affected. One bump, even although the egg does not get cracked or broken, is apt to spoil its chance of hatching.

DISINFECTANT IN STABLE MANURE.

C. S. KNIGHT, Mangere :—

Would you kindly inform me whether or not disinfectant in stable manure is injurious to plants. I have about 3 acres of pumpkins (the Red Warren squash variety), which were fairly heavily dressed with stable manure. The method adopted was to open a deep furrow, fill with fresh stable manure, cover over with about 3 in. of soil, and plant the seeds on the top. The crop has been almost a complete failure. I know the dry weather has handicapped them a good deal, but in spite of that I should have got a much heavier crop. My cucumber crop, treated in the same manner, has also been a failure. The stable manure used had disinfectant in it.

The Horticulture Division :—

The effect of disinfectants on stable manure would probably be to delay fermentation and decay, especially in a dry season. The disinfectants in general use and in usual quantities are not likely to be directly injurious to plants under such conditions as you describe. Your results are very likely due in the main to the dry season ; a deep furrow filled with fresh stable manure and covered with 3 in. of soil may be a suitable seed-bed in a moist season, but in the dry weather we have had this summer it must have been very unsuitable for such water-loving plants as pumpkins and cucumbers.

FORTHCOMING WINTER SHOWS.

Waikato Winter Show Association : Hamilton, 29th May to 5th June.
Otago A. and P. Society : Dunedin, 2nd to 7th June.
Poverty Bay Winter Show Association : Gisborne, 6th to 9th June.
Taranaki Metropolitan Agriculture Society : New Plymouth, 12th to 15th June.
Manawatu A. and P. Association : Palmerston North, 19th to 23rd June.
South Taranaki Winter Show Company : Hawera, 27th June to 4th July.
Auckland Winter Show Association : Auckland, 11th to 21st July.

WHEAT AND OATS THRESHINGS.

TABULATED below are returns of actual threshings received by the Census and Statistics Office up to 19th March from threshing-mill owners, and covering the months of January and February, 1928:—

Land District.	Wheat.		Oats.	
	Quantity threshed.	Average Yield per Acre.	Quantity threshed.	Average Yield per Acre.
	Bushels.	Bushels.	Bushels.	Bushels.
North Auckland ..	..	..	..	..
Auckland	311	18·29	..	..
Gisborne	1,947	26·31	..	..
Hawke's Bay	2,334	30·31	6,072	29·91
Taranaki	..	..	..	..
Wellington	23,526	39·34	9,186	39·77
Nelson	10,176	25·63	4,180	31·91
Marlborough	45,047	32·15	18,396	33·15
Canterbury	954,633	39·89	480,384	43·77
Otago	118,246	38·47	72,339	45·52
Southland	66	16·50	14,374	54·04
Dominion totals and averages	1,156,286	39·10	604,391	43·37

OCCUPATION AND UTILIZATION OF LAND IN NEW ZEALAND, 1926 AND 1927.

THE following table summarizes the condition of occupied land in New Zealand for 1926 and 1927:—

—	1926.	1927.
	Acres.	Acres.
Orchards, market gardens, vineyards, nurseries, and seed-gardens	32,433	31,252
Crops	1,645,719	1,769,862
Area occupied by residences, outbuildings, gardens, &c.	64,872	64,783
Fallow land	135,355	124,003
Sown grasses	16,615,960	16,680,348
Phormium tenax (New Zealand flax)	57,780	69,420
Tussock and other native grasses	14,298,618	14,197,853
Fern, scrub, &c.	4,165,576	4,123,743
Plantation	88,656	160,188
Standing virgin bush	4,176,569	4,099,032
Barren and unproductive land	2,325,291	2,267,214
Totals	43,606,829	43,587,698

In this table " barren " land is defined as that which is incapable of being put to profitable use, and not merely that which is barren because unused. Types of this land are mountain-tops, cliff-faces, shingle-beds, &c. It must be recalled that this table does not profess to give the condition of all land, as the total area of the Dominion is 66,390,262 acres, whilst the area occupied in 1927 was returned as 43,587,698 acres—a difference of 22,802,564 acres.

—*Census and Statistics Office.*

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THE GRASSLANDS OF NEW ZEALAND.

GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

(7) Danthonia pilosa.

"WHICH is the better grass—danthonia or brown-top?" This is a question often asked, and one that concerns the hill-country farmer most particularly. In my opinion these two grasses cannot well be compared; each is so characteristic of its own particular set of conditions that a fair comparison is extremely difficult. Brown-top under one set of environmental conditions is better than danthonia, but under another it is much inferior. Brown-top under brown-top conditions of soil-moisture, soil-fertility, &c., is better than danthonia growing on that same soil; but danthonia under its own conditions of soil moisture and fertility is better than brown-top growing under the same circumstances. The danthonia soil-type may be defined as a grade lower in quality and productiveness than the brown-top soil-type—dry, light lands of sunny aspect and low in available plant-foods (Figs. 119 and 120).

Danthonia is essentially a New-Zealander, and prior to the felling of the forest probably occupied a comparatively small space along the coast, where, by its binding and sward-forming capacity under poor and hard conditions, it healed over stabilized sand-dunes preparatory to scrub formation covering these areas. On the harder country, wherever breaks in the scrub communities occurred by slips or erosion or fire, we can imagine Danthonia pilosa spreading to the wound and healing the broken surface, preparing it once more for the scrub associations that follow as soon as the erosive effects of winds, rain, &c., are lessened by the sward of danthonia. Or in the South Island we can imagine breaks in the vast area of lowland tussock country becoming healed by this all-pervading pioneer which prepares the way for the ultimate climax formation of tussock grassland (Fig. 121), which, again, as it rises and becomes dense, smothers out its smaller, non-shade-enduring fellow-country species.*

In repeated burning of the tussock we see to-day the reverse taking place. The shade of the tussock is removed by fire, the crown

* Poa tussock may establish prior to a danthonia sward, using the mat plant scabweed as an establishment place for its seed.

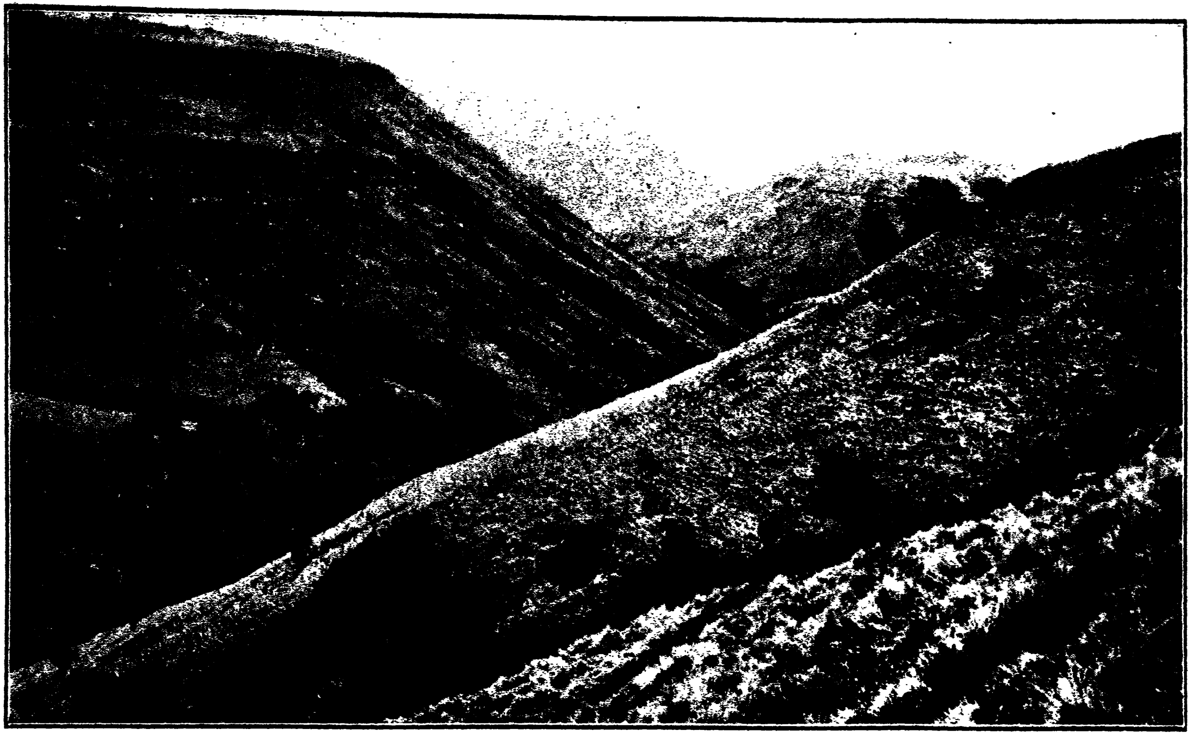

FIG. 119. COUNTRY ON WHICH DANTHONIA PILOSA IS DOMINANT.

Danthonia pilosa occupies a soil-type between brown-top on the one hand and Danthonia semiannularis, Grimmer grass, and bay-grass on the other. Hard, dry, friable, and unkindly soils, soils naturally low in available plant-food, or depleted soils characterize the danthonia habitat.

[*Photo by E. Bruce Levy.*

of this plant is damaged by heat and exposure, and wind plays havoc over the bared surface (Fig. 122). On this bared, wind-swept, sunlit surface Danthonia pilosa asserts itself, and begins once more its task of paving the way for the tussock advance (Fig. 123).

Danthonia is a pioneer that has been evolved by nature for New Zealand conditions to occupy barren areas, hard soils, dry soils, unkindly soils, and to prepare them for the advance of a higher class of vegetation. The clearing of the forest, the depletion of the fertility that that forest took ages to amass, the denuding of the humus layer of soil by repeated burning, and the constant outgo from the land of wool, beef, mutton, and butterfat have caused much of our country to revert to the original hard conditions, and danthonia has come in over millions of acres (Fig. 124). It has been reviled almost as much as brown-top, when all the time its presence is but a reflex of the original primitive hard conditions returning—conditions too hard for the forest immediately to reappear or for the high-yielding grassland species to thrive.

Danthonia-increase on the better-quality soils is in many places giving the lie to the claim of up-to-date methods where fertility maintenance of soils is the prime consideration. I unhesitatingly assert that increase of danthonia on the better country is a sure sign of insidious deterioration induced by poor farming, unscientific methods, and unfair methods such as drain the soil of its natural inheritance, the accumulation of ages. The incoming of danthonia is but a certain sign that henceforth the farmer can rely only on the natural plant-food resources of a primeval soil, unmellowed by years of humus accumulation or of detritus conveyed by flood and land-slide in the past. In natural New Zealand, Danthonia pilosa is virtually the lowest rung in the ladder of vegetation types. If conditions of soil and environment are such that this lowly type asserts itself, what opportunity or chance is there of getting high-production grassland species, such as rye-grass, cocksfoot, white clover, &c., to thrive? There is no chance until we artificially improve the conditions for such species.

This matter is purposely put very plainly here, for I feel the sooner the facts are realized by the farming community the quicker will we get down to bedrock as far as grassland improvement is concerned. The field for the improvement of the better-class soils that are running to danthonia is almost as great as that which lies in the elimination of brown-top by manuring, and the method of attack is much the same—namely, by use of the manure-bag, coupled with rotational grazing instead of close and continuous grazing.

DANTHONIA PILOSA AS A PIONEER.

There are great tracts of country in New Zealand clothed with vegetation types which are but a few degrees above danthonia in the ascending scale. Among these are tussock country, manuka country, cottonwood country, and even up to Southern beech (or "birch") and kamahi, which when destroyed and the humus they have accumulated and their ash have disappeared, leave the virgin surface that danthonia alone can permanently grass. Rye-grass, cocksfoot, crested dogstail, white clover, and even brown-top thrive only while working on the foods that the scrub and the forest have

FIG. 120. SHOWING DANTHONIA SOIL-TYPE WITHIN A GENERAL RYE-GRASS, COCKSFOOT, CRESTED DOGSTAIL, AND WHITE CLOVER SOIL-TYPE.

The hummocks shown in the photo are dry and infertile. These run dominantly to danthonia, while a sward of better grasses persists between, on the level and in the hollows, which aspects are not so dry and are more fertile.

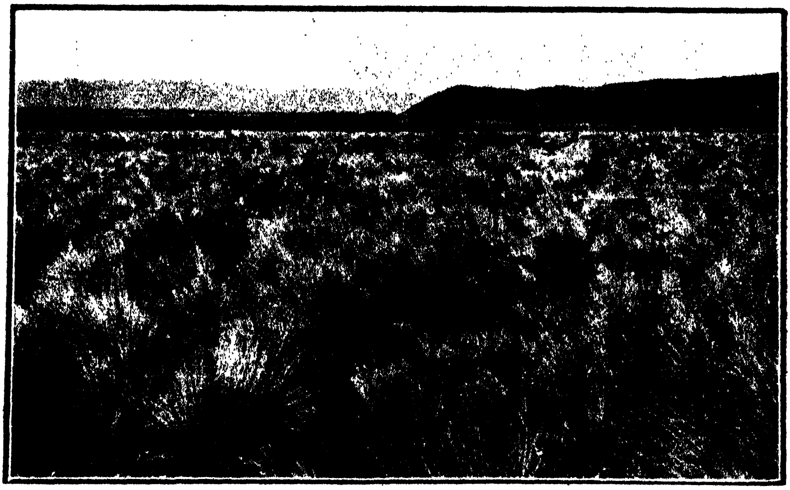

FIG. 121. NATURAL POA-TUSSOCK GRASSLAND.

A soil-type that runs dominantly to Danthonia pilosa when ploughed, sown down to permanent pasture, and left unmanured for some years.

[*Photos by E. Bruce Levy.*

amassed, and when this is gone danthonia dominance or low-fertility weeds prevail, or stunted scrub once more asserts itself. In the grassing of such soils that cannot be ploughed the introduction and establishment of danthonia is of prime importance, so that it may act as a basic pioneer upon which to work for the ultimate improvement of the country. There are extensive tracts brought in out of scrub and other low-vegetation types where the carrying-capacity has improved rather than gone back since the clearing of the scrub. The pioneer danthonia is largely responsible for the improvement. In virtue of large areas of the holdings becoming danthonia-dominant more stock can be maintained, and this means larger camping-areas on the ridges or more level portions of the farm and a consequent improvement of these. More sheep are held, and at shearing and docking time small special paddocks are improved. All this is due to the fact that out-back on the run danthonia is faithfully playing its part, covering more and more bare ground, inhibiting the establishment and reappearance of scrub, piripiri, &c., and at the same time adding its quota of feed, meagre though this may be, on the harder faces. Along with the danthonia such clovers as suckling-clover, clustered clover, striated clover, &c., may thrive, and in the spring these help greatly with the milk-flow of wet stock.

Not only does danthonia induce more stock, but it acts as an excellent pioneer in another way. Danthonia country left to itself will not remain in danthonia for long; scrub of one sort or another or fern soon asserts itself. The prevention of such return is a fundamental problem of hill-country farming. Danthonia will carry a fire well, and there is no cheaper means available to the farmer for the destruction of young scrub or fern than the firestick (Fig. 125). The fire sweeps over the danthonia without doing it the slightest permanent injury, but destroys most young scrub, and clears off, temporarily at least, bracken-fern and hard-fern. The removal of the shade of the fern and scrub enables fresh tillering-out of the danthonia (Fig. 126), and affords opportunity for further establishment of shed seed, until ultimately so dense a turf is formed that further establishment of scrub and fern is prevented. The presence of danthonia over thousands of acres of North and South Island hill country at least has enabled such areas ultimately to be cleared by repeated firing. The same is true of tussock country; but whether the tussock is to be regarded as a form of secondary growth to be destroyed, or some value as shelter for the grass and herbage between, must for the time being remain an open question. The burning-off of the tussock, however, favours the spread of the danthonia (Fig. 123).

Danthonia is a mat-forming plant, and spreads vegetatively by means of its underground short tillering rootstock (Fig. 127). It is a non-shade endurer, and shade of any sort inhibits its outward spread from the rootstock or establishment from seed. Plants will linger, however, for quite a long time in moderately dense shade, and will come away strongly once the shade is removed. On the sunny aspect its spread is most rapid; burning and close and continuous grazing admit light readily to the crown, and these practices favour greatly its spread. Owing to the crown being well below ground, and in virtue of a deep rooting-system, it is a fairly good drought-resister, and

FIG. 122. TUSSOCK COUNTRY CLEARED BY REPEATED BURNING.

Here the conditions are such as to favour the establishment and spread of danthonia, and to hinder re-establishment of tussock.

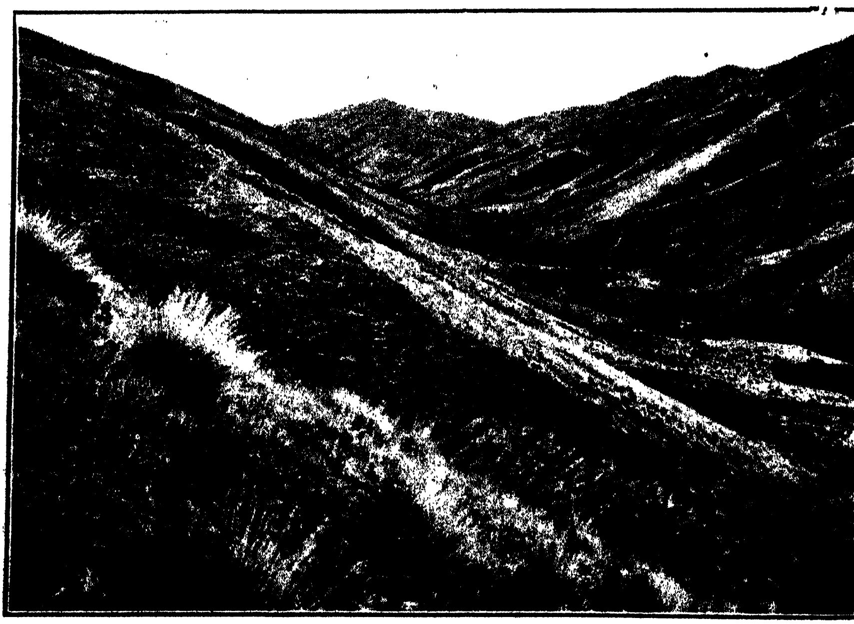

FIG. 123. TUSSOCK HILL COUNTRY WHERE THE TUSSOCK HAS BEEN DESTROYED BY REPEATED BURNING, AND RUNNING NOW TO DANTHONIA PILOSA DOMINANCE.

If the danthonia were left unburnt for some years poa tussock would begin to reassert itself.

[*Photos by E. Bruce Levy.*

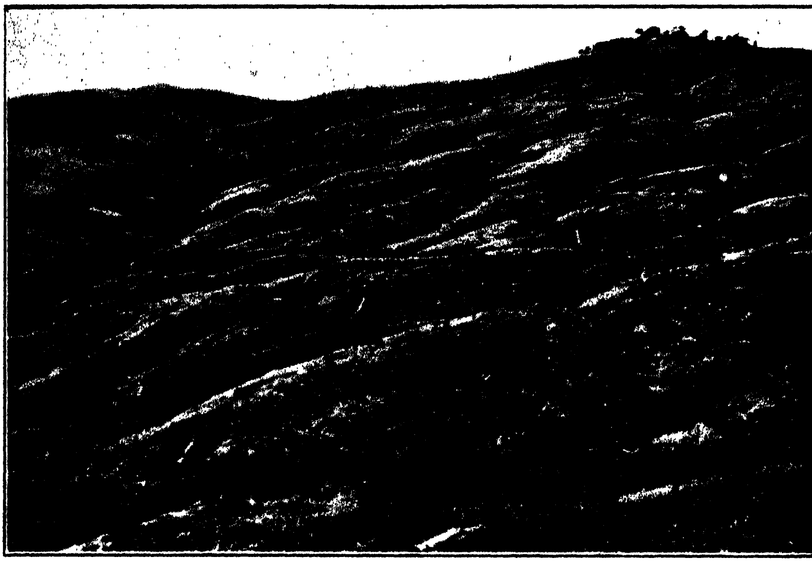

FIG. 124. DANTHONIA PILOSA ADVANCE ON SOWN GRASSLAND.

Bush-burn country which originally held good rye grass, cocksfoot, crested dogstail, poa pratensis, and white clover, showing these species being replaced by Danthonia pilosa. The white patches in the photo are danthonia. It will be noted that dominance of danthonia is first secured on the dry infertile knolls, and spread from here takes place as the soil-fertility becomes more and more depleted. Top-dressing such an area would stop the danthonia advance and confine it entirely to the poorer knolls.

FIG. 125. SECONDARY-GROWTH CONTROL BY FIRE ON DANTHONIA GRASSLAND.

Danthonia carries a fire perhaps better than any other grass. By means of it in a dry season a sweeping fire may be secured, and any young secondary growth may be checked or destroyed.

[*Photos by E. Bruce Levy.*

can spread vegetatively on exposed wind-swept and sun-baked slopes where ordinary pasture-plants rapidly succumb (Figs. 128 and 129). In addition to spreading vegetatively it establishes readily from seed shed on to the bare spaces, and this establishment under hard surface conditions from seed places danthonia in the fore rank of pioneers for the covering of such surfaces. On soils of low fertility where weeds of the catsear, rib-grass, cudweed type have already gained entrance to the pasture, danthonia once firmly established is able to replace these by virtue of its deep tillering-out, underground-stem system (Figs. 130 and 131). Moreover, such creeping, overground weeds as piripiri are gradually lifted off the ground and die out as the danthonia turf thickens up (Fig. 132). Control of most low-fertility-demanding weeds by a close and continuous turf is excellently well exemplified in danthonia.

The turf formed by danthonia, once all the ground is occupied, differs in many respects from the matted turfs that grasses such as brown-top or Chewings fescue make when these are growing under poor conditions outside their habitat range. The danthonia turf is sufficiently close and continuous to exclude most overground creeping weeds and rosette weeds of the catsear, dandelion, and rib-grass type, yet there is a certain openness, and upright annuals such as suckling-clover, hair-grass, &c., usually abound in danthonia pastures. This little openness is the life of the turf, and what has to be provided artifically by plough and disk and tripod harrows or hoof of cattle beast in the case of matted brown-top, Chewings fescue, paspalum, &c., is more or less naturally provided in danthonia—that is, aeration of the sward. This natural phenomenon illustrates one of the most important principles in grassland maintenance—that of soil-aeration. Air is as necessary to the life of the soil as it is to the aerial portions of the plant. Not only does it provide for the respiration of the subaerial parts of the plant and of soil micro-organisms, but there is a chemical action which leads to release of locked-up plant-foods present in all soils. To my mind it seems that each year by this natural ameliorating influence of air and sunshine there is sufficient plant-food unlocked to keep a danthonia turf thriving.

Danthonia-production, therefore, will represent the maximum growth possible on a soil when nature is unaided by man himself, and when the herbage that is annually produced is wholly absorbed by grazing stock and removed from the area concerned. Herbage allowed to accumulate on that area must in course of time lead to an increase there of available plant-foods. The principle of fertility-increase by spelling and converting the roughage produced into manure by the use of full-grown cattle beasts depends upon this fact (Fig. 133). Danthonia pastures, then, may be regarded as almost foolproof, and while production from such grassland may be low, the cost of production is also low. Danthonia is the cheapest grassland turf to maintain, and maintenance cost of any grassland sward is the deciding factor that must govern our choice of species for permanent-pasture work. Any soil can be made to grow high-production grasses and clovers—but at what cost? There is undoubtedly a point in grassland-farming where the maintenance cost of the better grasses and clovers is too high; in other words, there is much country—particularly hill country—where it does not pay to top-dress to the

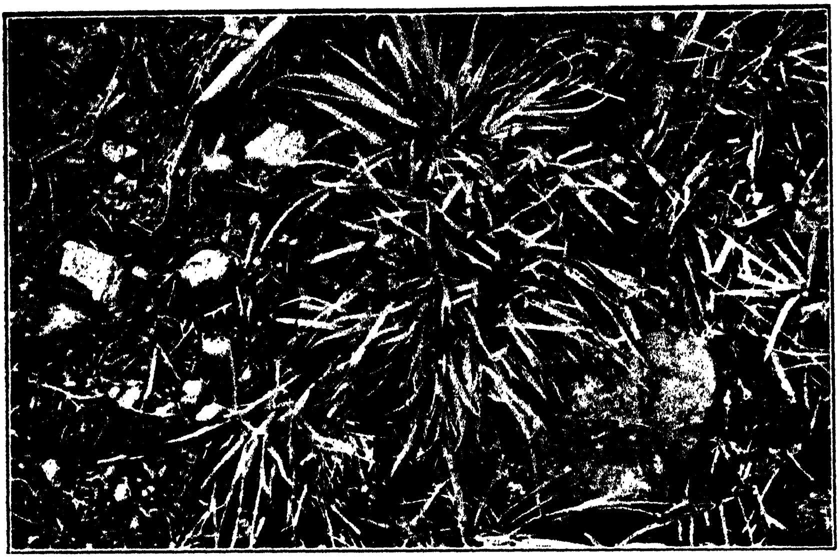

FIG. 126. RENEWED GROWTH OF DANTHONIA FOLLOWING BRACKEN-FERN BURN.

Danthonia-plants recover rapidly after a burn, and shed danthonia-seeds readily germinate and establish on the bared surface. The light reaching to the crown of the plant stimulates fresh tillering.

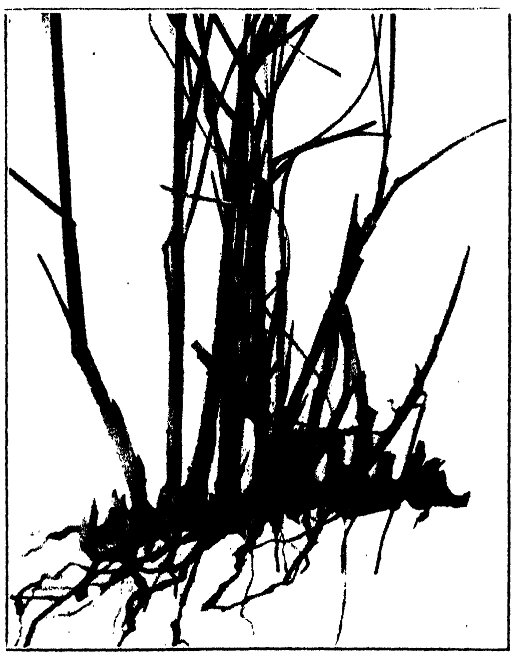

FIG. 127. SHOWING TILLERING UNDERGROUND ROOTSTOCK OF DANTHONIA PILOSA.

The crown is underground and the new tillers arise from the end or from lateral shoots of the short tillering rootstock. Light encourages outward spread of the rootstock, but shade retards its development.

[*Photos by E. Bruce Levy.*

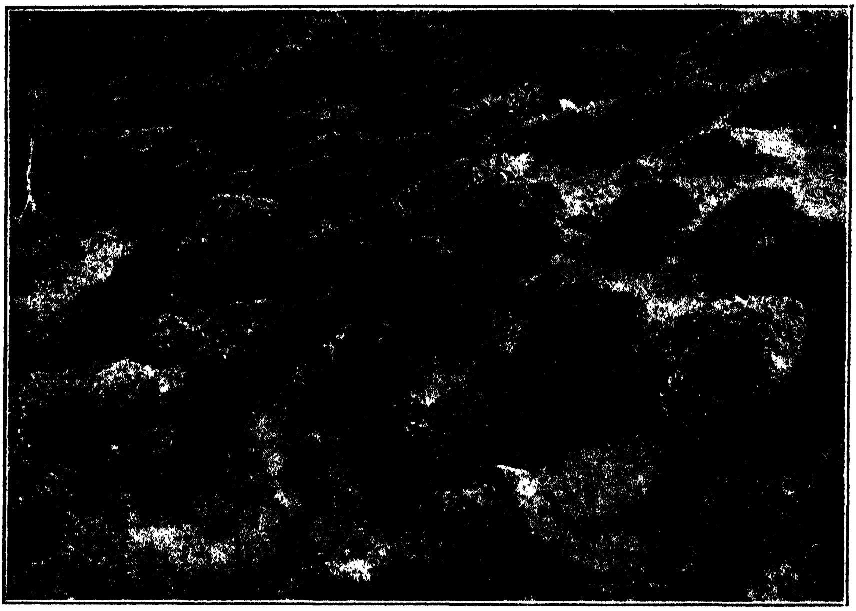

FIG. 128. DANTHONIA ESTABLISHING ON HARD, DRY, WIND-SWEPT FACE WHERE SUCH GRASSES AS COCKSFOOT UTTERLY FAIL.

FIG. 129. SHOWING SLOPE SIMILAR TO THAT IN FIG. 128 AT A FURTHER STAGE.
The danthonia is here joining up plant to plant to form a close and continuous turf.

[*Photos by E. Bruce Levy.*

standard required by the better grasses and clovers. Just where that line comes in is difficult of determination, but below that line Danthonia pilosa is the grass *par excellence*. It is essentially the grass for big acreages where it is wellnigh impossible to assist nature other than by reasonable grazing methods.

Although danthonia dominance over large tracts of country is here justified, and no other grass considered more desirable to secure, I must vigorously condemn the farming of danthonia on arable land or on land that can conveniently be top-dressed. As in the case of brown-top, the call to the grassland-farmer is to top-dress danthonia out, beginning first on the easy, readily accessible, and naturally more fertile areas, and gradually working back to the poor hillsides. The farmer himself will soon find out in this way where the economic line between the better grasses dominant and danthonia-dominant must be drawn. Phosphate response on danthonia-dominant turf is slow, even where the country is sufficiently moist to render available the more soluble of the phosphates (Fig. 134). From experiments conducted by the Department of Agriculture to date on danthonia turf in the Taranaki District it would appear that at least 10 cwt. per acre of phosphatic manure is necessary before there is any appreciable change in the composition of the pasture. Certainly the danthonia itself is rendered more palatable, owing no doubt to increase of mineral phosphate present in its herbage, and also from the fact that more young growth is produced. The production and utilization of young growth form, indeed, the crux of grassland management.

Dry soils, or soils with a long dry critical period in the yearly cycle, are more or less destined to become danthonia-dominant so far as truly permanent pastures are concerned, for there the farmer is powerless to conserve sufficient moisture to render consistently available even the most soluble phosphatic manures. On ploughable country the provision of annual crops is an essential characteristic of such districts, but where the plough cannot be used danthonia dominance is probably the only thing to meet the case. In the Hawke's Bay District there appear to be cycles of rye-grass subdominance in what is normally danthonia country. It is difficult to account for such unless on the assumption that during a dry season there is little outgo from the soil, and that there is going on continuously within it the aeration and amelioration mentioned earlier, so that actually an accumulation of plant-food takes place; thus as soon as good rains occur a sufficiently high fertility exists to stimulate the rye-grass persisting in the danthonia, and if only this state could continue rye-grass rather than danthonia would predominate. I feel certain that these better rye-grass and white clover seasons synchronize with some ameliorating influence that has been at work for some time previous to the renewed growth of the pasture, and it does seem hopeful, even on dry areas where it apparently does not pay to top-dress, that research will find a means of improving artificially the turf now danthonia-dominant.

FORMS AND STRAINS OF DANTHONIA.

There are apparently many forms of Danthonia pilosa, and this group would justify much close systematic work in order to develop the better strains. For the improvement of danthonia country, and for

FIG. 130. WEED-INFESTED PASTURE WHERE THE SOWN GRASSES HAVE FAILED AND WHERE DANTHONIA HAS NOT BEEN INTRODUCED.

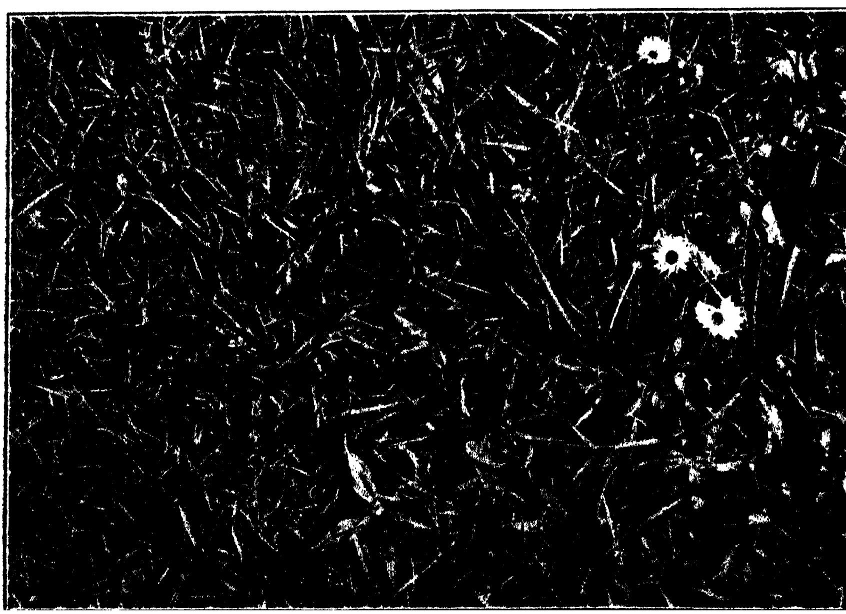

FIG. 131. DANTHONIA INVASION OF WEED-INFESTED PASTURE.

On left of photo Danthonia pilosa has ousted most of the weeds, and is progressing forward on right

[*Photos by E. Bruce Levy.*

the good of great areas destined yet to carry a danthonia sward, work of selection, isolation, and propagation of the better strains should be undertaken. I am of opinion that the improvement of danthonia country lies not in the selection of a cocksfoot or a rye-grass to suit this hard soil-type, but it is the best danthonia that we require. Similarly for brown-top country it is the best brown-top that should be exploited, and so on with cocksfoot or rye-grass country. High permanent production, however, will not be accomplished, I feel, by the plant-breeder alone, but by the farmer who is prepared to feed the best strain that the plant-breeder can produce. The higher the powers of any grass to produce, the greater will be the need for adequate manuring. The normal danthonia-plant is a low producer; its inherent capacity to produce but little is the secret of its persistence on poor soils, and is its undoing on fertile soil, where it is asked to compete with strong-growing brown-top, cocksfoot, or rye-grass. It is only when the production of these latter species falls away to below the normal production of danthonia that this grass is able to gain and make headway in the turf (Fig. 135). Would that this fact could be instilled into the farming mind of this country! It would surely bestir the more progressive at least to keep a closer watch over their country, particularly those areas that have held good grasses for the last twenty years or more but which are now running to danthonia-dominant. All such country, I claim, could be manured back. It is for country that never held the better grasses for any length of time that I hesitate to assert the possibility of economically manuring out the danthonia.

DANTHONIA AND GRASS-GRUB.

In much the same way that danthonia has asserted itself over artificially sown grasslands, so, too, have certain native insects found congenial the precincts of sown grassland. Particularly is this the case with the grass-grub (*Odontria* spp.) and the subterranean caterpillar (*Porina* spp.), the adult woolly moth of which latter is so familiar at night-time about any artificial light. Certain grasses resist the attack of these two insects, but none so well as danthonia (Fig. 136), and one can well imagine how danthonia-spread is often indirectly facilitated by the ravages of these two grassland pests.

DANTHONIA UNDER SHADY AND SECONDARY GROWTH CONDITIONS.

Danthonia is a poor shade-endurer; quite a small amount of shade retards its vegetative spread and stops all establishment from seed. Nevertheless, danthonia lingers well within moderate shade, and its recovery once that shade is removed is an outstanding characteristic that fits this grass as a pioneer *par excellence* in the grassing of scrub and fern infested areas. Each burning lets in the light, which induces renewed and vigorous danthonia-growth from the old plants, and permits of germination and establishment of shed seed on the bared surface. Each burn, or each time the fern is crushed, encourages the spread of danthonia and weakens the secondary growth. The sunny faces are naturally the best lighted, and here we find the incoming and spread of danthonia most rapid. For the shady faces, where the illumination is comparatively poor, brown-top is better than

FIG. 132. DANTHONIA WINS AGAINST PIRIPIRI.

This photo was taken in one of the worst piripiri areas the writer has seen. Virtually the only places free of this weed were those where Danthonia pilosa had established itself. The dense turf formed by the danthonia forces the creeping overground stem of the piripiri off the ground, and this makes possible its control by cattle-stocking.

[*Photo by E. Bruce Levy.*

FIG. 133. DANTHONIA COUNTRY SPELLED (LEFT OF FENCE).

The spelling of danthonia country reacts in two ways: (1) By the shade the growth creates, the spread of danthonia itself is inhibited, while such grasses as cocksfoot and Poa pratensis are benefited; (2) by an accumulation of roughage, which later is converted largely into animal-manure per medium of full-grown cattle (not burned off), an actual increase in fertility is effected. Burning-off of such rank growth is justified only when control of secondary growth is the objective.

[*Photo by W. D. Reid.*

danthonia (see *Journal* for January last, page 12). The presence of danthonia among the scrub serves both to draw the stock and to carry the fire. Danthonia also retards the spread of hard-fern, particularly once the country ages, and its presence in a dry season ensures burning of hard-fern patches to the very edge.

DANTHONIA PILOSA ON THE PRIMARY BURN.

Danthonia is moderately slow to establish from seed, and no danthonia-plant at all will establish on the more fertile portions of the primary burn. Here rye-grass and cocksfoot exclude all possibility of danthonia-establishment, and just so long as these species last the need for danthonia is not felt. Those portions of the burn not so fertile (as pointed out in my January article) run to brown-top dominant, and on the very poorest spurs and knolls is found danthonia. It is also found in the weaker portions of the brown-top, becoming greener than the latter and spreading outwards as this species dwindles on the poorer aspects after three or four years. So remarkably true to aspect conditions do these species come to group themselves that one is apt to strain the credulity of readers who have not followed closely this matter for themselves. The better grasses thrive under one set of conditions, brown-top and Lotus major under another, and lastly, valiantly holding the extreme outpost of soil-types, is Danthonia pilosa. No hill country is so good that danthonia should not be included in the seed mixture of the primary burn. Its presence is the best insurance policy against ultimate deterioration that the farmer can take out for his farm. It will spread only when the conditions become too hard for the better species to thrive; it will fill up by reseeding any vacant spaces in the turf or which come to exist there, and will go a long way to prevent weeds of one sort and another gaining entrance. I have seen on quite new bush burns a complete sward of catsear, the outcome of non-inclusion of brown-top or danthonia; and again in large tracts of bush-burn hill country the only portions free of piripiri were those where danthonia had taken charge. Small as may seem the return from danthonia for the first two or three years on the primary bush burn, I would unhesitatingly recommend the inclusion of seed of this grass in the mixture. It is frequently asserted that there is no need to include danthonia, as it comes in naturally in later years. This, too, is true; but it is also true that many a bush-burn area has gone through a long period of weeds—piripiri, catsear, cudweed, hard-fern, &c.—before danthonia became introduced in this way An amount of 2 lb. to 3 lb. of Danthonia pilosa per acre should be included in all seed mixtures for primary forest burns.

DANTHONIA PILOSA ON THE SECONDARY BURN.

The secondary scrub or fern burn always presents more difficult conditions than does the primary burn; hence the need for the establishment of danthonia is still more pressing. There are in New Zealand large tracts of country which have had many secondary burns over them that to-day are danthonia-dominant grassland, and yet little or no danthonia has been sown. On secondary burns over areas adjacent to such danthonia-dominant country, or when burning areas where danthonia is already established, its sowing may not be necessary,

FIG. 134. TOP-DRESSING RESPONSE ON COUNTRY RUNNING TO DANTHONIA.

On this area, in the Whangamomona district, 6 cwt. of basic slag has been applied over a period of two years, and the soil fertility is now approaching white-clover standard, as shown by this species coming back. On old danthonia country 10 cwt. or more of phosphatic manure is necessary to get much return of white clover.

FIG. 135. DANTHONIA PILOSA (ON RIGHT) AND COCKSFOOT (LEFT) ON LOW-FERTILITY SOIL.

The danthonia is here beating the cocksfoot in production, and consequently is able to gain in the sward. Photo taken in mid-February, when cocksfoot-growth should be at its peak.

[*Photos by E. Bruce Levy.*

as stock, particularly sheep, readily distribute the seed from one area to another, and weak plants within the scrub or fern strengthen rapidly once the shade is removed. It matters not how the seed comes to be sown on the secondary burn, whether by sheep or out of the seed-bag, the important thing to bear in mind is the need for the danthonia there. If the secondary burn is to be top-dressed, the danthonia will not spread in the face of superior vegetation; but as a safeguard, should top-dressing have to be abandoned, every care should be taken to ensure the establishment of danthonia. There are dry knolls where it will probably never pay to top-dress to the standard demanded by the higher-production species. These knolls should be in danthonia, else they become a breeding-ground for weeds. For all aspects too poor and too dry for brown-top, danthonia is essential.

CONCLUSIONS.

Danthonia pilosa occupies a soil-type between brown-top on the one hand and Danthonia semiannularis, Grimmer grass, and bay-grass on the other. In the soil-fertility scale it, as it were, occupies the second degree from the bottom. The Danthonia pilosa soil-type is entirely characteristic, presenting hard conditions, either from low moisture content or paucity of plant-foods. Where the limiting factor is moisture, danthonia may become dominant; but dominance on moist soils is almost certainly the reflex of low fertility—either naturally low or depleted by poor farming methods, such as close and continuous grazing over long periods and paying no attention towards making good the drain on the mineral resources of the soil. Danthonia dominance or spread in a pasture is a sure indication that conditions are too hard for the better grasses to thrive. It is not a question of danthonia ousting the sown English grasses, but of danthonia following up the retreat of the better sown species. Danthonia will not invade a high-producing turf of brown-top and Lotus major, or of crested dogstail, cocksfoot, rye-grass, and white clover. It is only when these are so reduced in vigour by being starved that danthonia can beat them in production. When this is the case danthonia will spread, but not otherwise.

Danthonia is a great pioneer on poor, hard soils—on stabilized sands, on manuka, stunted bracken-fern, cottonwood, poa-tussock, and beech and kamahi country. Here danthonia is about the only grass to be relied upon to hold permanently without top-dressing. In virtue of such aspects on the farm being covered with some sward of grass more stock can be kept, and this means the improvement of certain of the easier country in use as sheep-camps, holding-paddocks, &c. The rough danthonia also provides a certain amount of winter feed for cattle, and where scrub or fern is again putting in an appearance the danthonia, spelled for a growing season, readily carries a fire, excepting in certain of the wetter west coast districts. Through this attribute of danthonia many thousands of acres of hard hill country have been cleared of scrub and fern. The danthonia carries the fire, but itself is undamaged. The repeated firing of danthonia country, however, leads to almost pure danthonia, and prohibits the return of any of the better grasses such as cocksfoot and rye-grass. Spelling the danthonia hinders its own development from the crown, and

encourages greatly the return of Poa pratensis and cocksfoot. Then when these spelled areas are cleaned up in the winter by cattle the roughage is largely converted into quickly available manure, which encourages greatly the return of rye-grass.

Danthonia growing well is highly palatable when young, and on the moister and slightly more fertile portions it is found to be grazed equally with the rye-grass and white clover that may be persisting among it. On the harder knolls and steeper faces it is less palatable than on the slightly better aspects, owing to the smaller amount and less vigorous young growth produced. This original small difference

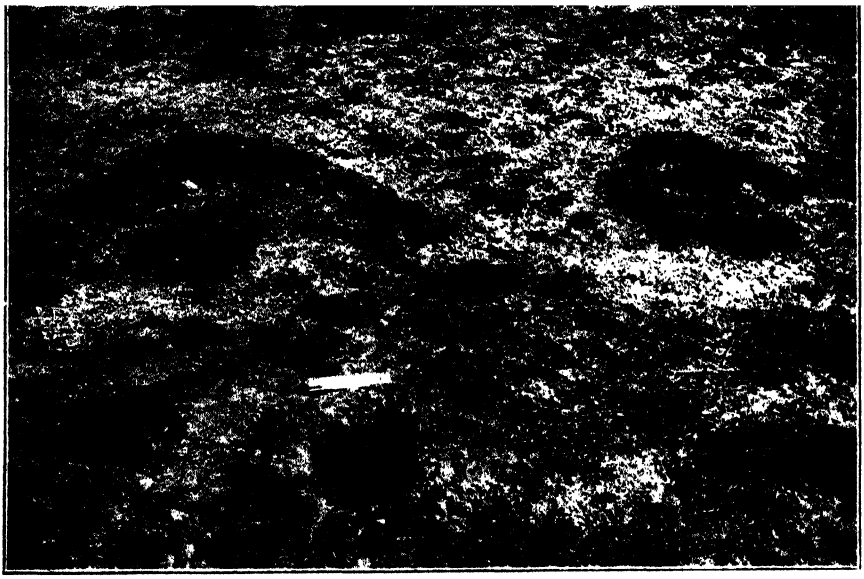

FIG. 136. GRASSLAND BARED BY GRASS-GRUB (ODONTRIA SPP.).

The dark patches are plants of Danthonia pilosa that have resisted the ravages of the grub. In foreground, hole 6 in. square from which twenty-one of the larvæ were taken.

[*Photo by E. Bruce Levy.*

in palatability, together with more difficult accessibility to stock, soon means a ranker growth and a consequent further reduction in palatability. Hence on certain knolls and harder faces danthonia may scarcely ever be eaten until the winter-time, and some farmers are apt to draw conclusions damning to danthonia, judging it solely on its behaviour on such aspects. The farmer is apt to consider the more palatable better-grazed portions as dominantly English grasses, whereas really danthonia is the dominant grass there also, but is kept young and palatable because well grazed.

As in the case of brown-top, danthonia may be manured out, but, generally speaking, it will take more manure to effect the same improvement in danthonia-dominant country than where brown-top is dominant. On soils brought in from manuka and stunted bracken-fern, cottonwood, poa tussock, and beech probably 10 cwt. or more of artificial manure will have to be applied before danthonia dominance

begins to wane. In such cases, however, the increase of palatability is very marked, ensuring a better and much more uniform grazing of the area. In those big blocks of country where rye-grass has held well for the last twenty years, but which are now running to danthonia, probably 3 cwt. of manure per acre will turn the tables against the danthonia advance. It is on this latter class of country that top-dressing is almost certain to pay handsomely right from the offset. In the case of the harder country it seems a case of spending some £3 an acre to get the country into a state where further top-dressing will pay. On the more difficult of such country danthonia is likely to remain the dominant grass.

Danthonia is a native of New Zealand, evolved to clothe its primitive soils. By its growth it prepares the way for the higher class of vegetation which replaces it. The removal of this vegetation by man and the depletion of the fertility which it has built up by its growth tend towards a repetition and renewal of the original primitive soil-surface, and nature again calls to her service Danthonia pilosa. The incoming of Danthonia pilosa, then, means that one is thrown back on to the primitive resources of the soil, and as such it is useless to expect anything higher-producing than danthonia to thrive. Danthonia may be taken, therefore, to represent the natural production of wide areas in New Zealand unaided by artificial manures or other practices that go to build up soil-fertility. Where these latter practices are impracticable the successful establishment of danthonia should be provided for as an insurance against weeds by sowing it on the primary and secondary burn, putting 2 lb. or 3 lb. per acre of good seed in the mixture sown for either class of burn.

(Series to be continued.)

STATISTICS OF FARM MACHINERY AND ENGINES.

FOLLOWING is a summary of farm machinery and engines employed on rural holdings (outside borough boundaries) in New Zealand for the past five years: —

Class of Machinery, &c.	1923.	1924.	1925.	1926.	1927.
Milking plants	13,553	14,553	15,561	16,301	17,000
Cream-separators	40,916	42,473	44,056	45,765	45,240
Shearing-machines—					
Plants	5,317	5,480	5,728	5,949	6,305
Stands	17,304	17,844	18,445	18,797	19,269
Wool-presses	8,179	8,035	8,601	8,641	8,832
Agricultural tractors	439	512	1,026	2,025	2,588
Reapers-and-binders	15,380	15,048	15,881	15,574	15,287
Threshing-machines	343	332	377	361	364
Chaffcutters	3,061	2,970	2,903	2,865	2,562
Water-wheels or motors ..	1,129	871	846	817	784
Electric motors	1,339	2,587	3,451	6,356	8,436
Steam-engines	709	626	622	473	435
Internal-combustion engines ..	18,209	18,804	19,894	19,584	18,885

—*Census and Statistics Office.*

IRON-STARVATION (BUSH SICKNESS) IN STOCK.

FARMERS' EXPERIENCE WITH ADVISED REMEDIES.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

THE application of remedies the logical outcome of the adoption of the theory that "bush sickness" is really iron-starvation is in practical farming now beginning to show highly encouraging results. Previous published accounts of experiments have referred entirely to those conducted on either the Government Demonstration Farm at Mamaku or on leased areas under the supervision of departmental officers. The results outlined in this article are those conducted by practical farmers of repute who have carried out the work entirely by themselves, sometimes diverging from the official instructions and often varying the method of administration of the prescribed drug (iron-ammonium citrate) to suit themselves.

The area over which these farms are scattered is a very wide one, extending from the Bay of Plenty on the east coast to Putaruru in the Upper Waikato basin. The present statement of the position is made in general terms, often in the farmer's own words taken down on the farm itself by an expert officer of the Department, who therefore had an opportunity of applying something in the nature of a check. Only those farmers who had secured quantities of the iron remedies from the Department were visited. The fact of their continuous purchasing of the drug since January, 1927, may be held to be something of a proof that those who are using the iron scales are satisfied with the results obtained.

The article is thus not to be taken as a scientific record, but as an unbiased expression of opinion from practical men, and it is published in the hope of inducing other practical men to persevere with a remedy for a deficiency disease which is retarding the progress and holding up the settlement of extensive areas of country.

DISTRICT A (ABOUT 300 FT. ABOVE SEA-LEVEL).

Farmer "D," who has been using citrate of ammonium and iron scales for the past seven years with good results, has adopted the practice of putting a dessertspoonful of the scales into a 200-gallon drinking-trough from time to time. The water is, of course, being renewed intermittently, and the owner tests the requirement of the water for more iron by tasting it. When the iron-taste disappears another spoonful is added. All this farmer's calves are reared by the aid of the same drug.

Farmer "V," on the same road as Farmer "D," has had good results by dissolving the scales in the water-trough in a similar way to the method of his neighbour "D," and rears his calves by putting the scales into the feed milk.

DISTRICT B (ABOUT 1,000 FT.).

Farmer "E" has had good results in dosing cows with the solution of the iron scales.

Farmer "K," of same place, cured sick calves by dosing them with the iron scales.

Farmer " M " has had great results using a top-dressing of powdered sulphate of iron (hydrated ferrous sulphate) and superphosphate, and reckons that he " saved the situation " with his milking-cows by using that mixture. He also top-dresses with a basic slag and superphosphate mixture. This season he reared his calves on the top-dressed paddocks without dosing the calves with any iron medicine. He has bought quite a lot of sulphate of iron from the manure-merchants after his experience of a small parcel of the same compound provided by the Department of Agriculture.

DISTRICT C (ABOUT 1,000 FT.).

This district is reputed to be one of the most " bush-sick " areas in the affected region of the North Island.

Farmer " H," who has a farm with a bad reputation for the "skinnies," milks cows and rears his own calves, and is now getting as good a return as those of his neighbours who carry on by periodically changing their stock to healthy country. His system is to dose the whole herd for about three weeks every three months with the iron remedy. This treatment consumes 1 lb. of the citrate for each animal in the year, at a cost for the drug of 3s. 3d.; whereas by changing the stock it would cost him at least 2s. 6d. per week for two months in each year for every animal, involving an expenditure of £1 per annum for grazing fees alone. This method, besides the extra cost, has also the inconvenience and difficulty of working necessitated by the seasonal requirements of the animal. This farmer's stock (twenty cows and one bull) have, with the exception of two old cows, been reared on his farm under the medicinal method of treatment.

Farmer " D " and Farmer " F " also report satisfactory results from using iron and ammonium citrate scales. The latter farmer cures " bush-sick " animals with this medicine.

DISTRICT D (ABOUT 200 FT.).

Farmer " B " considers his land now quite healthy since top-dressing with phosphates and iron sulphate. He formerly used, but now has ceased to use, citrate of iron and ammonium medicinally.

Farmer " W," on the same road, uses the citrate with success as a medicine.

DISTRICT E (200 FT.).

Farmer " M " speaks highly of the effects of giving each of his cows 2 oz. of the solid scales per day for a period. He does not mind wasting some of the drug, as he says it " pays him to." He is a progressive, prosperous farmer, and the fact that since January, 1927, he has bought 126 lb. of the drug from the Stock Office is proof of the genuineness of his testimony. Such men are the pioneers of farming, unafraid to push new methods to the limit. However, one does not advise quite such heroic treatment to be attempted by others until more is known about the results of excessive dosage and the possible damage that the cows may suffer, especially when given at critical periods in the life of the cow. It is best to keep to the maximum official dose, which is 2 fluid ounces of a 6-per-cent. solution twice a day for each cow.

DISTRICT F (900 FT.).

Farmer " M " is a strong believer both in top-dressing with sulphate of iron and in dosing his cows and calves with iron-ammonium citrate. He has ceased to change his cows to healthier pasture since adopting the new treatment, and is now raising all his own calves. He is now one of the strongest supporters of the iron treatment both for soil and animal. He is a thoroughly practical and successful Scottish farmer.

DISTRICT G (ABOUT 500 FT.).

Coming to a district remote from the others mentioned, and where it was found that a large amount of the iron compound was being used, the largest user was interviewed. Farmer " V " stated that he was never able to rear his calves until this season, when he had done much better after using iron scales in the milk feed of the calves. Of these, seventeen out of twenty-two were thriving and in good condition. The remaining five calves scoured, but were picking up.

The Authoritative Methods.

It may be useful to again summarize the full authoritative method of coping with iron-starvation in stock. The following are the recommendations for farming-lands of the volcanic "soil-province" classified as sandy silts and gravelly sands of the Rotorua County (see maps published in the issues of the *Journal* for June, 1926, and August, 1927) :—

(1) Farm more highly; get the plough in; compact the soil; grow plenty of winter feed; and save plenty of hay. Subdivide into smaller paddocks, and keep the pastures eaten short. Top-dress with phosphate—preferably containing iron or in conjunction with iron sulphate—as frequently as is the practice to top-dress in the Waikato. Treat the stock well, especially in the matter of water-supply.

(2) Use molasses freely in the feeding, especially in rearing young stock. Regard molasses as a preventive, but not as a cure.

(3) When an animal shows signs of going back in condition owing to iron-hunger, give double citrate of iron and ammonium as supplied by the Stock Inspectors at Rotorua and Tauranga at cost price to *bona fide* farmers. The dose for a cattle beast is 2 fluid ounces of a 6-per-cent. solution twice daily; 1 lb. of the scales may be dissolved in 13½ pints of water to make this solution. The medicine may be sprinkled on hay or other fodder for ease of administration. For younger animals the dose should be proportionately reduced.

(4) Buy any stock required from districts remote from the affected pumice land, and under conditions which ensure that the animals are free from disease or parasitic infection. Lack of the mineral elements is known to predispose an animal to other diseases and ailments, which, when introduced on to a farm on sick country, run a rapid course in the stock.

THE BLACK LOGANBERRY.

WITH reference to the warning published in the March issue of the *Journal* (page 203) concerning the so-called black loganberry, a leading Auckland nurseryman advises that he imported this variety some twenty years ago from California under the name of " mammoth blackberry," again five years ago from Australia as " black loganberry," and last year from England under the name of " lowberry." These plants were found to be identical and equally undesirable in characteristics.—*J. A. Campbell, Director, Horticulture Division.*

COMMON AILMENTS OF LIVE-STOCK AND THEIR TREATMENT.

(Continued.)

J. LYONS, M.R.C.V.S., Director of the Live-stock Division, Wellington.

Mammitis (Inflammation of the Udder).

THE damage wrought and the loss sustained by the ravages of mammitis throughout New Zealand amount in the aggregate to considerable proportions annually. It is doubtful, indeed, if any other disease present among our dairy herds is the cause of such extensive loss to farmers. However, owners of dairy herds in this country are not more unfortunate in this respect than dairymen in other parts of the world. The disease is known in every country where dairying is carried on; the loss and trouble caused thereby are world-wide.

Cause and Symptoms.—There are various organisms which give rise to mammitis, chief of which are those organisms belonging to the cocci group. These gain entrance into the lining tissues of the milk-gland and set up inflammation, which may vary in its intensity in accordance with the severity of the infection, the variety of infecting organism, or the resisting-powers of the affected animal.

In this country the disease is usually seen in what may be termed the subacute form, and may affect one or more quarters. Acute cases, however, are by no means uncommon. The accompanying inflammation is so slight at the outset of the disease that it cannot be recognized by either sight or touch, and the only indication that mammitis is present is a slight curd which can be seen if the first quart of milk from the affected quarter is examined. In many cases this is all that can be seen for the first few days. Gradually, however, the germs begin to multiply, and a greater number of milk-cells are implicated, until the effect of the inflammation can be felt or is visible to the naked eye, and the quantity of curd and matter in the milk has also increased.

In a quarter so affected, if the body-cells are not sufficiently active to destroy the organisms causing the disease and thus terminate its ravages, the organisms must attack the greater part of the secreting cells and destroy their function, thereby rendering the quarter useless. It is to be regretted that this is by far the most common ending when once a quarter becomes affected with mammitis. It is, however, by no means uncommon to see such cases recover spontaneously.

In acute cases the symptoms are more intensified, and are frequently accompanied by constitutional disturbances, in some cases to such an extent that the animal goes completely off its food. There is considerable heat, pain, and swelling in the parts affected, and the accompanying secretion is of a reddish-brown colour with a fœtid odour. In such cases it is seldom that the quarters affected return to normal. In fact, many such cases end fatally, owing to the reabsorption from the affected parts. Again, it is often found that abscesses have formed in the affected quarter. This is due to the organisms causing the disease gaining access to the interstitial tissues of the udder. In such cases the abscess should be opened when ready and free drainage allowed.

Prevention.—It has been demonstrated that mammitis is due to organisms, and if these can be prevented from gaining access to the animal-tissues our object is attained. In order to do so the dairyman's energy should be directed on ways and means to prevent the germ from gaining entrance to the system. To this end he should see that the dairy-shed and surroundings are kept as clean as possible. Diseased quarters should not be milked on to the floor of the shed, and should the material from an affected quarter escape by chance that part of the floor should be immediately cleaned and disinfected, otherwise portions of the material may be carried on to the pastures and become a source of infection to other cows. Milking-machines or the milker's hands should not be used on affected quarters and then brought in contact with healthy udders. For this reason it is necessary to see that all animals suffering from affected quarters are kept to the last, and milked by hand. The sound quarters should be milked first, and the affected afterwards. A bucket containing a quantity of antiseptic should be kept solely for this purpose, into which the affected material should be milked, and afterwards buried or destroyed. Even among the apparently healthy animals every care should be exercised to see that the machines are not placed upon affected quarters. Before being applied the attendant should draw a little of the first milk from each quarter into the hand, and if any clots are seen such an animal should be milked by hand for the time being, so as to prevent further risk of infection. In order that the chance of infection may at all times be reduced to a minimum it is necessary that the machines be kept scrupulously clean, as should also the hands of the milker.

Another feature in connection with the prevention of mammitis is the liability of the udder to become injured from various causes, such as overstocking (leaving the milk too long in the udder), and, what is even a still greater source of injury, running the machines at too high a pressure or keeping them working too long on the udder after the milk has been withdrawn. Under such conditions the udder-tissue is liable to become injured, and, owing to its enfeebled resisting-powers, is less able to withstand the invasions of the organism than if it had remained uninjured. For this reason the greatest care should be exercised to see that the milking-machines are always running at an even pressure, and not too high a pressure. Nor should they be left on after the milk has ceased to flow.

In giving these hints on preventive methods I fully realize the difficulty in carrying them out. The continual supervision of those in charge is required, and, in these days of restricted labour, care and tact need to be exercised. I feel satisfied, however, that were the instructions carried out in their entirety owners of herds would be fully compensated for their extra labour by (1) extending the usefulness of many of the individual members of the herd, and (2) by producing a better article.

In order to obviate the care and attention necessary to keep their herds as free as possible from mammitis many owners, both in this and other countries, have had the animals vaccinated, with a view to rendering them immune from an attack of the organism. The method of inoculation is a simple one, and had it proved successful a great boon would have been conferred on the dairy industry throughout

the world. It is to be regretted, however, that this method of prevention has so far failed to convey the desired immunity. Vaccines have also been tried as curative agents. Here again the results have not been satisfactory.

Treatment.—In treating mammitis it must be remembered that the disease is caused by an organism within the secreting tissues of the udder, and that it must be destroyed, either by the body-cells or by some other agent having germicidal action, before recovery can take place. For this purpose many medicinal agents, such as boracic acid, chinosol, &c., in solution, and ether and formalin in the form of spray, have been tried; but while in many cases a considerable degree of success has been attained it cannot be said that any of these methods of treatment give entire satisfaction. The method of treatment found to be most successful is good drainage. The udder should be stripped as frequently as possible, so as to clear away all debris and thus give the affected tissues every possible chance of recovery. Some American authorities claim highly satisfactory results from stripping out the udder every two hours night and day. Unless in the case of a very valuable animal, however, this practice is not likely to be carried out in New Zealand.

Prevention is what should be aimed at, however, and with this end in view, as already stated, too great care cannot be exercised in the way the herd is handled, and in keeping the surroundings and equipments of the shed in such a state of cleanliness as will reduce disease-carrying germs to a minimum.

Cow-pox (Variola vaccina).

This is a contagious disease characterized by an eruption on the surface of the udder and teats, which, if not interfered with, passes through several definite stages, and ultimately ends in a dark-coloured scab which falls off in about three weeks, leaving a pitted surface.

When once cow-pox makes its appearance in a herd it is liable to spread by the hands of the milkers from cow to cow, until the whole herd becomes affected. The management of such a herd is most unsatisfactory. The affected cows become upset while being milked, and this is liable to upset the others, and under the circumstances it is not uncommon to find the whole herd in a more or less excited state before the milking is finished. This is bound to have a diminishing effect on the milk-yield. Besides, there is always a danger of affected animals contracting mammitis through the affected material entering the teat-ducts.

Symptoms.—The eruption first makes its appearance as a small red papule. This in turn becomes a blister or vesicle containing fluid, which after a few days breaks and discharges pus or matter. Ultimately it dries up and forms a crust, which in due course drops off. A succession of papules may appear, and various stages of the disease may be seen on the udder at the same time. This, of course, prolongs the period of attack. As stated, if not interfered with the disease runs a definite course. This, however, is almost impossible when the vesicles appear on the teats. These are almost sure to be broken in the process of milking, with the result that slow-healing wounds appear.

Prevention.—As the disease is chiefly carried by the milking-machine or the hands of the milker, affected animals should be kept by themselves and milked by a special attendant, who should not be allowed to handle or milk the healthy animals of the herd.

Treatment.—Cow-pox being a disease which runs a definite course, little medical treatment is necessary. When the vesicles rupture, the parts should be kept clean and dressed with boracic or zinc ointment. Should it be necessary to milk affected animals with a teat-siphon, care should be taken to see that it is always boiled before being used.

Fistula of the Teat.

This trouble is generally the result of a barbed-wire cut. When the cow is in milk, before a fistula can form, the injury must extend to the teat-duct and allow the milk to escape through the opening made. Such a wound, owing to the milk continuously leaking through, ends in a fistula or opening in the teat. Any attempt made to close the opening when the cow is in milk is bound to end in failure. For this reason the operation should be delayed until the cow has gone dry. The edges of the opening can then be scarified with a pair of surgical scissors, and the scarified edges brought together by fine catgut sutures. The opening should be painted with iodine before and after the operation. If the opening is not too large a small stick of nitrate of silver may be used to cauterize it. The inflammation thus set up serves to unite the edges. When cauterizing it is necessary to see that the material is not too liberally used, otherwise the caustic may escape into the teat-duct and cause it to become obliterated.

Warts on the Teats.

It frequently happens that individual cows among a herd suffer from warts on the teats, which occasionally extend to the skin of the udder. These give considerable trouble when the animal is being milked. They can be removed without any great inconvenience to the cow, either by pulling them off or by clipping them at their junction with the skin with a pair of surgical scissors, after which the wounds should be painted with tincture of iodine. The operation should not be attempted when the animal is in milk. When the growths are small considerable benefit is derived from the application of castor oil after each milking

Milk Fever.

This important disease occurs in every country where dairying is carried on. In New Zealand it can be seen in almost every district during the calving season, although more common in some localities than in others. The symptoms are so well known as to require but little description, and yet the cause of the disease is still hidden in obscurity. The treatment is well known, however, and for this a debt of gratitude is owed to the Danish veterinarian Schmidt, who discovered a successful treatment some thirty years ago. This consisted primarily of pumping iodide of potassium into the udder; but within a few years the method was changed to inflation with air. Previous to Schmidt's discovery all sorts of therapeutic measures had been tried, and still the death-rate remained enormous. Since the discovery, however, the mortality has been reduced to such an extent that stockowners no longer look upon the malady as a serious one.

The disease pertains essentially to milch cows, and heavy milkers are more liable to become affected. It is met with more particularly after the third calving, although heavy milkers from the third to the fifth parturition period are also more liable to infection. It cannot be said that older or younger animals are free from the complaint, nor can it be said that the best-conditioned or the heaviest milkers are always the ones that become affected.

Symptoms.—These usually appear at any time up to three days after calving, but they are by no means confined to this period. Well-marked cases have been observed previous to parturition, while it is not uncommon to see typical cases weeks or months after calving. If the symptoms are observed from the outset the animal will be seen to paddle with the hind feet and stagger if forced to walk, the eyes become bloodshot and staring, with twitching of the eyelids, and vision is impaired or may be altogether lost. Finally the animal loses all control and falls down, and in some instances it may succeed in rising, only to fall again and ultimately become comatose. Occasionally a case is met with where the patient is delirious, struggles violently and bellows, dashes her head about, and is in a highly excited state. Such cases are far more difficult to treat, and the chances of recovery are not nearly so good as with the comatose or quiet state. It is seldom, however, that violent symptoms are observed. What the owner usually finds is the cow on the ground unable to get up. While on the ground she will be in one or other of two positions—(1) lying quietly on her sternum (breast-bone) with her head tucked into the flank; (2) lying flat on her side, in which position she will be struggling, with the stomach distended with gas.

Treatment.—This consists in stripping the udder clean of milk, rendering the teats aseptic by the application of tincture of iodine, and inflating the udder with air. After each inflation the teat should be tied with a soft rag to retain the air in the quarter; the animal should then be placed on her sternum and kept in this position. Recovery may be expected in from four to eight hours, according to the stage at which the treatment has been applied. If the treatment has been applied early the course of the disease will be greatly modified. In fact, by inflating the udder before the animal goes down the disease is cut short and a rapid recovery can be looked for. In a number of cases a relapse may occur. The animal, after recovery, in getting on to its feet goes down a second or even a third time, and all the symptoms return. However, I have seen several of these cases ultimately make a good recovery.

In treating milk fever, besides inflating the udder with air, it is essential that the animal should receive careful nursing, and that the attendant should refrain from the administration of medicine. If nursing is neglected the animal is liable to roll on to its side, in which case the stomach will become distended with gas, which will retard recovery or even cause the death of the animal. If drenches are administered there is a liability of the drench entering the windpipe, on account of the animal being unable to swallow. The liquid enters the lungs and sets up inflammation, which will ultimately prove fatal.

In all cases, when the animal has recovered, the air should be removed gradually. This is best accomplished by stripping the udder every few hours throughout the day.

(To be continued.)

CERTIFICATION OF SEED POTATOES.

OPERATION OF THE SYSTEM IN SEASON 1927–28.

J. W. HADFIELD, H.D.A., Agronomist, Department of Agriculture, Christchurch.

AN article dealing with the inauguration of seed-potato certification in Canterbury was published in the *Journal* for August, 1927, but before proceeding to the present review it may not be out of place to repeat the salient features of the scheme. The object of certification is to supply information that will enable merchants and growers to obtain seed that is true to name and reasonably free from tuber-borne diseases. Growers are asked to submit crops for inspection, and to forward with their application one hundred sets from the seed they intend planting. These samples are grown under uniform conditions where they can be watched carefully and the various lines compared with one another. During January the grower is visited and the crop carefully inspected. A second field inspection is undertaken just before digging, and a final tuber inspection is made when the seed is graded and ready for sale. Any grower who has a crop which passes the necessary standards in regard to purity and freedom from disease is issued with a certificate and sufficient certification-tags to enable him to attach one tag to each sack of potatoes he is selling.

The matter of grading for size is entirely between the vendor and purchaser, and has not been taken into consideration, although it may, at a later stage, be found desirable to standardize the grading as adopted in the inter-Island trade for table potatoes.

The Past Season's Operations.

Every one interested in potatoes will acknowledge that a great deal of confusion exists in regard to the naming of varieties. It is proposed to discuss this aspect of the question more fully in subsequent articles to be published in the *Journal*. In the meantime, however, it is necessary to make a brief statement on certain matters of importance to those who are interested in the seed-potato trade, and which have direct bearing upon certification.

NAMING OF VARIETIES.

As one of the objects of certification is to clear up the confusion in regard to varietal nomenclature, it is obviously undesirable to certify to a variety under more than one name, thereby suggesting that they are distinct varieties. Several varieties will now be discussed from this aspect.

(1) *Sutton's Supreme, Aucklander Tall-top, and Aucklander Short-top.*—It seems doubtful if the original Sutton's Supreme is grown commercially in New Zealand at the present time. It probably went out of favour in Canterbury shortly after the severe invasion of late blight in 1905, and it is not even procurable now from Messrs. Sutton and Sons, England, who raised the variety. Aucklander Short-top and Aucklander Tall-top are selections made from Sutton's Supreme about 1905. The tall-top variety is about three

FIG. 1. GENERAL VIEW OF THE DIFFERENT LINES OF UP-TO-DATE POTATOES UNDER TRIAL AT ASHBURTON EXPERIMENTAL FARM.

[*Photo by H. Drake.*

FIG. 2. LATER VIEW OF THE UP-TO-DATE POTATOES SHOWN IN FIG. 1.

Note the difference of maturity among the potatoes, due to the incidence of diseases.

[*Photo by A. W. Hudson.*

weeks later than the short-top, while the latter is probably six weeks later than Sutton's Supreme. Both the Auckland varieties are sold in the North Island under the name of Sutton's Supreme, and to avoid confusion the tags issued in certifying these two varieties will be branded respectively—

Auckland Tall-top (N.Z. Sutton's Supreme).
Auckland Short-top (N.Z. Sutton's Supreme).

(2) *Dakota.* Certification of Dakota crops has necessitated more discrimination than with any other variety. There is no great difficulty in identifying the Leader variety, which has a deep-yellow flesh, nor is it difficult to identify such varieties as Beauty of Hebron (pink), Early Rose, Scotia, and Russet Reading, when grown as pure lines. The Dakota, however, appears to have a wide range of variation (possibly due in some measure to virus diseases), and it has been extremely difficult to decide upon a limit of variation inside which a plant is termed a Dakota and outside which it must be deemed an impurity. A typical Dakota is easily recognized, and some very uniform crops have been inspected. In other crops the characteristics of the tuber shade off imperceptibly, and no doubt soil and climatic conditions materially affect the general appearance. The variety is of great commercial importance, and is the subject of special attention in the potato-selection work now in progress. It will be some years before these selected lines will be available, and in the meantime an attempt is being made to certify to the most uniform and disease-free crops.

(3) *Beauty of Hebron (pink) and Early Rose.* These two varieties have, quite generally, been sold under whichever name appeared the most desirable. It is doubtful if any pure seed of Early Rose is available, yet they should be dealt with as distinct varieties, and it is hoped pure lines will be available within a few years. In the meantime the mixture will be certified to as "Early Rose - Beauty of Hebron (pink)" rather than eliminate the varieties from certification.

(4) *Beauty of Hebron (white) and Early Puritan.* There is still confusion regarding these varieties, which, according to the most reliable information available, are identical. Beauty of Hebron (white), as grown in New Zealand, has a tuber flushed with rose, and will be the subject of comment in a subsequent article. All lines of Early Puritan sent in for certification were Bresee's Prolific, and as not one line of either variety has passed the necessary standard any pronouncement regarding nomenclature can conveniently be postponed.

(5) *Magnum Bonum and Bresee's Prolific.*—Nine lines of Bresee's Prolific and five of Magnum Bonum were entered for certification In all cases the Magnum Bonum lines proved to be Bresee's Prolific, and have been certified accordingly.

(6) *Northern Star and Gamekeeper.*—These two varieties have been so intermixed as to render it necessary to certify them as Northern Star - Gamekeeper. There exists considerable variation within the mixture, and selection work is being undertaken with a

FIG. 3. MAJESTIC AND IRON DUKE VARIETIES.

The centre row is the true Majestic variety. The adjoining rows in full flower are the Iron Duke variety commonly grown in parts of Canterbury and incorrectly named "Majestic."

[Photo by H. Drake.

FIG. 4. FARMERS INSPECTING THE CERTIFICATION POTATOES DURING A FIELD-DAY AT THE ASHBURTON EXPERIMENTAL FARM.

view to separating the varieties. One which has become popular under the name of Britain's Best is probably identical with Northern Star.

(7) *Majestic (Findlay's) and Iron Duke.*—Although the Majestic variety has not been included within the scope of certification this past season, a number of lines were sent in by growers, and it is intended to include the variety next season. For this reason it may be advisable to mention that the variety grown most commonly as Majestic—a strong-growing plant with large trusses of heliotrope flowers and round oval tubers—is in reality President or Iron Duke. The true Majestic (Findlay's) has somewhat spreading foliage, white flowers, and produces long oval (kidney) tubers, with shallow eyes. Both these varieties will be included within the scope of certification next season under the names "Majestic" and "Iron Duke" (the latter name being apparently better known than "President")

ISSUE OF PROVISIONAL CERTIFICATES.

It has already been stated that certificates and certification tags are not to be issued till the graded seed has been inspected. This obviously places the grower and merchant in an unsatisfactory position, in that neither is able to come to terms regarding a line of seed until it is picked over, bagged, and ready for delivery. It has therefore been decided to issue provisional certificates, with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their produce.

The certificate states that the crop has passed all field inspections, but has not yet passed the final tuber inspection; further, that a certificate and certification tags will be issued later, provided an officer of the Department of Agriculture inspects the graded seed tubers and is satisfied that they are still of the standard in regard to purity and freedom from disease as was indicated by the previous field inspection. This certificate should go a long way towards facilitating business, and transactions should be made provisionally upon the seed passing the final tuber inspection.

The following growers have been issued with provisional certificates:—

	Dakota.	Area. Acres.
G. E. Benny	Southbridge R.M.D.	2
F. W. Carpenter	Prebbleton	19
J. Carr	Mount Hutt Rural, Methven	1
W. J. Crozier	Mount Hutt Rural, Rakaia	30
G. Hurst	Overdale P.O., Mitcham	4
W. McLachlan	Hills Road, Leeston	16
W. McPhail	Mitcham, Mount Hutt R.D., Rakaia	13
A. Paul	Highbank, Methven	3
W. Shellock	Mead Settlement, Rakaia	6
E. A. Smith	Broom Farm, Lincoln	25
C. E. Walker, jun.	West Melton R.M.D.	2
	Robin Adair.	
Muff Bros.	Orari, South Canterbury	4
L. T. Wright	Annat	2

		Area. Acres.
	Early Regent.	
*W. Eder	Sefton R.M.D.	35
	Bresee's Prolific.	
W. Barnes	199 Highstead Road, Papanui	7
J. Boag	Middlerigg, Brookside	2
D. H. Butcher	Broadfields R.M.D.	5
F. W. Carpenter	Prebbleton	30
J. Carr	Mount Hutt Rural, Rakaia	1
W. Chappell	Killinchy R.M.D.	5½
W. C. Lowery	Southbridge	18
D. Marshall	Killinchy R.M.D.	32
L. J. Palmer	Southbridge	4
G. H. Simpson	Templeton	1
	Aucklander Short-top.	
F. Brundell	Camside, Kaiapoi	5
J. W. Ferguson	Kaiapoi R.M.D.	38
C. H. Jordan	Kaiapoi R.M.D.	4½
S. G. McCullough	Rangitira Valley, Temuka	3
W. E. Martin	Kaiapoi R.M.D.	9
A. J. Rich	Kaiapoi R.M.D.	10
R. Smith	Kaiapoi R.M.D.	5
	Aucklander Tall-top.	
J. Bailey	Kaiapoi R.M.D.	6
Doak Bros.	Fernside, Rangiora R.M.D.	4
J. D. McMullan	Elmwood, Kaiapoi	8
H. S. Moore	Box 4, Kaiapoi	7
A. J. Rich	Kaiapoi R.M.D.	5
	Epicure.	
R. Gray	St. Andrews	1
D. Marshall	Killinchy R.M.D.	6
Muff Bros.	Orari	1½
I. Robinson and Son	184 Cashel Street, Christchurch	3
W. Shellock	Mead Settlement, Rakaia	1
	Arran Chief.	
A. Mortland	Templeton	10
F. A. Rollinson and Sons	Studholme Junction	20
*F. Saunders	Studholme Junction	4
J. W. Smith	203 Ilam Road, Fendalton	2
	Northern Star - Gamekeeper.	
H. Watts	Willowby R.M.D.	35
	Endurance.	
R. G. Bishop	Southbridge R.M.D.	1
	Up-to-date.	
S. Cross	Courtenay R.M., Rolleston	3
C. E. Walker, jun.	Courtenay R.M., West Melton	6
F. Westaway	Courtenay R.M.D.	4

* Final certificate issued.

Extension of System in 1928–29.

The scheme, which has been confined to Canterbury during the past season, has met with considerable support, and applications have been received for extensions to other parts of the Dominion. Next season's operations will therefore cover Canterbury, Otago, and

Southland, and growers are invited to send in applications and obtain full particulars from the Department's Instructors in Agriculture in their respective districts.

Areas of 1 acre or more of any of the following varieties, if grown in Canterbury, Otago, and Southland, will be eligible for inspection during 1928-29 season :—

Arran Chief.
Aucklander Short-top (N.Z. Sutton's Supreme).
Aucklander Tall-top (N.Z. Sutton's Supreme).
Beauty of Hebron (pink).
Beauty of Hebron (N.Z. White Beauty of Hebron).
Black Kidney.
Bresee's Prolific.
British Queen.
Brownell's Beauty.
Dakota.
Duke of York.
Early Puritan.
Early Rose.
Early Regent.
Elephant.
Endurance.
Epicure.
Field-Marshal.
Gamekeeper - Northern Star.
Gold Coin.
Golden Wonder.
Great Scott.
Iron Duke (President).
Kerr's Pink.
King Edward.
Langworthy.
Magnum bonum.
Majestic (Findlay's).
Maori Chief.
Northern Star - Gamekeeper.
Perfection New Era.
Robin Adair.
Sharpe's Express.
Snowdrop (Witch Hill).
Up-to-date.

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1927.

N. R. Foy, Seed Analyst, Biological Laboratory, Wellington.

DURING the calendar year 1927 a total of 10,768 seed-samples were tested at the Agriculture Department's Seed-testing Station, representing an increase of 2,141 samples over the number dealt with for the preceding year. The aggregate was made up as shown in Table 1. The considerable increase may be attributed to the reduction in testing fees as from 1st April, 1927, this being evidenced by the fact that the extra business was almost wholly made up of commercial samples.

The number of samples received during each month for 1927 and 1926 is shown in Table 2; and Table 3 sets out the actual number of tests made and number of samples submitted for germination or purity or both. The number and percentage increases on the year's working are also shown, the purity tests leading in the latter respect.

Table 4 shows the number of samples received from the different land districts and the centres therein. It will be seen that with the exception of Auckland there has been an increase in all the main districts.

Table 5 gives the number of samples of the various species received for tests, and the number of tests—purity or germination—made on each individual species.

GRASSES.

The average percentage germination and purity of the main grass-seeds are given in Table 6. Compared with the figures for previous

Table 1.—Origin of Samples received and tested, 1927 and 1926.

Senders.	Number of Samples.		Increase or Decrease in 1927.
	1927.	1926.	
Seed-merchants	8,959	6,852	2,107 increase.
Farmers and seed-growers	233	399	166 decrease.
Government Departments	351	289	62 increase.
Laboratory tests	1,078	944	134 increase.
Retests	147	143	4 increase.
Totals	10,768	8,627	2,141 increase.

Table 2. Number of Samples received in each Month, 1927 and 1926.

Month.	Number.		Month.	Number.	
	1927.	1926.		1927.	1926.
January	490	642	July	892	739
February	682	560	August	1,258	994
March	1,038	753	September	1,412	907
April	776	546	October	1,007	1,096
May	1,000	650	November	982	723
June	753	616	December	478	401

Table 3.—Classiacation and Numbers of Samples and Tests, 1927 and 1926.

Classification.	Number.		Increase in 1927.	
	1927.	1926.	Number.	Per Cent.
Samples for germination only	7,641	6,731	910	14
Samples for germination and purity ..	2,868	1,785	1,083	60
Samples for purity only	259	111	148	133
Purity tests made	3,127	1,896	1,231	65
Germination tests made	10,500	8,516	1,993	23
Totals and general percentage ..	13,636	10,412	3,224	31

Table 4.—Number of Samples from the different Land Districts and Centres therein.

Land District.	1927.	1926.	Land District.	1927.	1926.
Southland	**3,377**	**1,979**	Auckland	**1,066**	**1,320**
Gore	1,493	..	City	900	..
Invercargill ..	1,774	..	District	166	..
District	110	..	Otago	**602**	**599**
Wellington	**2,328**	**1,900**	Dunedin	549	..
City	1,301	..	District	33	..
Palmerston North and Feilding	672	..	Marlborough.. ..	**228**	**129**
			Hawke's Bay ..	**213**	**228**
District	350	..	Taranaki	**129**	**59**
Canterbury	**1,680**	**1,142**	Gisborne	**47**	**9**
Christchurch ..	1,073	..	North Auckland ..	**24**	**3**
District	607	..	Nelson	**1**	**8**
			Westland	..	..

years, there is nothing calling for special note, except that the germination of rye-grass as a whole, as in 1926, was considerably depressed, only 9 per cent. of the samples germinating in the 90's and one-third in the 70's. This is due mainly to the lower average growth of Southern seed, which, as can be seen from Table 7, shows only 3 per cent. in the 90's.

The average purity and germination of the main grasses is shown according to place of origin in Table 7. Chewings fescue and crested dogstail show a high standard of quality in 1927, which was a particularly good year for these two seeds. The export demand for Chewings fescue was particularly good, the United States absorbing a record

Table 5.—Number of Samples of the various Species, 1927 and 1926, and Number of Tests made thereon, 1927.

Species.	1927.			1926.
	Germination Tests.	Purity Tests.	Samples.	Samples.
Lucerne	85	16	85	85
Alsike	54	13	54	60
White clover	387	246	444	333
Cow-grass and red clover	436	262	495	317
Crimson clover	24	7	24	23
Suckling-clover	30	23	30	11
English trefoil	34	10	34	31
Lotus major	55	28	58	83
Other clovers	88	19	88	73
Perennial rye-grass..	2,713	849	2,748	1,744
Italian rye-grass	433	147	450	255
Western Wolths rye-grass	159	28	160	181
Timothy	86	35	86	88
Crested dogstail	1,163	515	1,187	768
Danthonia spp.	96	58	106	68
Brown-top	207	140	217	171
Chewings fescue	670	458	697	554
Meadow-fescue	33	8	33	29
Meadow-foxtail	21	4	21	30
Yorkshire fog	27	24	30	16
Cocksfoot	492	141	501	433
Paspalum	83	13	83	113
Poa pratensis	36	10	36	66
Prairie-grass	19	..	19	34
Other grasses	49	10	49	65
Japanese millet	14	..	14	32
Oats	29	1	29	31
Barley	74	2	74	27
Other cereals	8	..	8	23
Mangolds	201	31	201	171
Turnips	433	69	433	372
Swedes	292	44	292	288
Rape	153	6	153	115
Kale	115	3	115	75
Carrots	149	7	149	101
Forest-tree seeds	121	..	121	77
Flower-seeds	..	..	..	6
Vegetables (other than peas).. ..	280	..	280	143
Peas	144	..	144	133
Tares, vetches, &c...	6	..	6	14
Grass and clover mixtures	16	17	25	21
Miscellaneous forages	23	..	23	18

Table 6.—Average Germination and Percentage of Extraneous Seeds for the Main Grasses, 1927.

The figures in parentheses in second column are 1926 averages.

Species.	Percentage of Germination.			Percentage of Samples germinating in Groups—						Average Percentage of Impurities.	
	Average.	Highest.	Lowest.	0–49.	50–59.	60–69.	70–79.	80–89.	90–100.	Commercial Seeds.	Weed-seeds.
Perennial rye-grass	75 (77)	100	11	2	8	16	33	32	9	1·1	0·4
Italian rye-grass..	84 (87)	100	6	0	3	5	19	37	36	0·1	0·2
Western Wolths ..	82 (81)	99	16	2	2	6	21	35	34	0·2	0·3
Timothy ..	88 (91)	99	5	1	3	6	9	9	72	0·3	0·1
Crested dogstail ..	91 (84)	100	8	..	4	..	4	12	80	1·2	0·2
Cocksfoot ..	70 (69)	96	12	5	12	25	32	20	3	3·5	0·7
Brown-top* ..	85 (78)	99	4	3	4	6	11	20	56	0·7	0·8
Chewings fescue ..	86 (82)	100	0	..	5	..	9	16	70	1·0	0·4
Meadow-fescue ..	74 (63)	98	0	4	3	24	9	4	56	0·1	0·7
Poa pratensis ..	57 (48)	94	31	36	20	22	11	8	3	5·2	0·8
				0–19.	20–29.	30–39.	40–49.	50–59.	60–100.		
Meadow-foxtail ..	18 (36)	39	0	60	20	20	0	0	0	1·8	3·3
Danthonia spp. ..	52 (46)	76	15	3	3	17	16	21	40	16·5	9·0
Paspalum ..	41 (38)	82	2	0	0	0	94	6	0	0·5	4·1

* Average percentage of pure seed, 84 per cent.

Table 7.—Average Germination and Purity of Perennial Rye-grass, Crested Dogstail, Cocksfoot, and Chewings Fescue, grouped according to Place of Origin, 1926 and 1927.

Origin.	Average Percentage of Impurities.	Percentage of Samples germinating in Groups—								Average Germination.		Number of Samples.	
		Under 70.		70–79.		80–89.		90–100.					
		1926.	1927.	1926.	1927.	1926.	1927.	1926.	1927.	1926.	1927.	1926.	1927.
						Perennial Rye-grass.							
Southern ..	1·5	36	29	30	36	20	32	5	3	74	74	963	1,737
Canterbury	1·1	12	18	22	25	37	35	29	22	83	80	363	441
Sandon ..	1·1	18	26	16	31	32	33	34	10	81	74	102	154
Hawke's Bay	0·8	3	18	4	7	14	38	79	37	93	83	95	100
Dominion..	1·5	25	26	24	33	31	32	20	[illegible]	77	75	1,744	2,713
						Crested Dogstail.							
Southern ..	1·3	11	2	11	4	24	12	54	82	87	92	503	987
Sandon ..	1·0	9	3	3	1	28	6	60	90	86	94	58	89
Dominion..	1·4	15	4	11	4	24	12	50	80	84	91	768	1,103
						Cocksfoot.							
Akaroa ..	3·6	83	73	15	23	2	4	0	0	62	63	75	127
Danish ..	1·9	21	16	43	38	34	44	2	2	76	76	126	124
Plains ..	9·3	15	41	40	31	34	17	11	11	79	71	35	54
Dominion..	4·3	43	44	27	33	27	20	3	3	69	70	435	492
						Chewings Fescue.							
Southern ..	1·4	10	5	10	9	38	16	42	70	82	86	554	670

quantity of seed. It would appear that both Chewings fescue and crested dogstail are being allowed more opportunity to thoroughly mature before harvesting, as, although shipment conditions are much the same now as they were several years ago, there have been no reports of the complete failure of consignments (particularly of fescue), which were so frequent at that time.

With the evidence at hand it is difficult to assign the low germination of most rye-grass to the factor of immaturity, although it is possible that with the increasing amount of top-dressing the plants are stronger in growth, and the seed is in consequence later in commencing and completing maturity. This statement is purely hypothetical, although it is freely stated in some districts that top-dressing is detrimental to the germination of the seed. Provided the seed is allowed to mature on the plant, there should be no detrimental after-effect from the application of artificial fertilizers.

In general, a high standard of purity was maintained in the samples. Cocksfoot, Poa pratensis, meadow-foxtail, paspalum, and danthonia were the only species wherein the average percentage of impurities exceeded 2 per cent., and only in the last three named did the weed-seed content exceed 1 per cent. The standard of purity for brown-top has been raised considerably, much of the seed received being over 96 per cent. pure, with an average over all samples of 85 per cent. In 1925 brown-top gave a pure-seed average of only 62 per cent. This higher standard of quality is due to the increasing production from Southland and Canterbury, in which districts the seed can be produced at a price which allows merchants to dress up to the full weight.

Noxious impurities: Californian thistle occurred in 5 per cent. of the rye-grass (1 per cent. Canterbury, 4 per cent. Southern), in 33 per cent. of the dogstail, in 2 per cent. of the Chewings fescue, and in 3 per cent. of the brown-top. Ox-eye daisy occurred in 4 per cent. of the Danish cocksfoot and 1 per cent. of the brown-top, in which latter were also noted a few seeds of dodder and ragwort. The occurrence of the seeds of ox-eye daisy, field foxtail, chamomile, and mayweed in several samples of Akaroa cocksfoot furnished conclusive evidence of the practice of blending Akaroa seed with Danish, of which latter seed the impurities specified are indicators. This blending has been noticed for several years past, but it was much more in evidence in 1927. Likewise, two samples of lucerne containing impurities foreign to Marlborough seed were submitted as Marlborough seed. Under the terms of the new Seeds Importation Act, which came into force last month, 1 per cent. of all imported cocksfoot and lucerne seed must be coloured red, so that the practice of substituting or blending foreign and home-grown seed will be absolutely prevented.

CLOVERS AND RELATED SPECIES.

The average germination and purity of the main clovers and related species is shown in Table 8. With the exception of crimson clover and English trefoil, all the species dealt with in the year under review were of high quality as regards germination. Over 2 per cent. of impurities is shown in white clover, alsike, Lotus major, and suckling-

clover, but only in the last-named does the weed-seed content exceed 1 per cent.

Noxious impurities: Dodder occurred only in 1 per cent. of the cow-grass samples, in 1 per cent. of white clover, and in 10 per cent. of Lotus major. Californian thistle occurred in 1 per cent. of cow-grass and white clover samples, and in 10 per cent. of Lotus major —all in very small quantities. Alsike for the first time on record at this Station was free from Californian thistle.

Table 8.—Average Germination and Purity of the Main Clovers and Related Species, 1927.

Figures in parentheses in second column are 1926 averages.

Species.	Percentage of Germination.			Percentage of Samples germinated between				Seed Impurities.				Average Percentage of Hard Seeds.
								Number of Species		Average Percentage.		
	Average.	Highest.	Lowest.	0–69.	70–79.	80–89.	90–100.	Commercial Seeds.	Weed-seeds.	Commercial Seeds.	Weed seeds.	
White clover ..	86 (89)	100	0	6	15	42	37	10	67	2·6	0·6	11·0
Alsike	82 (86)	97	18	9	9	49	33	11	21	2·8	0·5	7·6
Cow-grass ..	87 (90)	99	6	4	8	37	51	23	69	0·4	0·3	9·4
Lucerne ..	75 (83)	99	41	28	36	16	20	10	8	0·4	0·1	17·4
English trefoil ..	64 (77)	100	0	50	26	17	7	8	15	1·3	0·3	14·0
Crimson clover ..	77 (94)	100	59	29	13	37	21	6	16	0·1	0·3	0·0
Lotus major ..	70 (78)	99	10	52	15	11	22	15	33	4·5	0·9	25·0
Subterranean clover	88 (91)	99	46	5	0	52	43	3	3	0·1	0·1	11·5
Suckling-clover ..	60 (77)	80	28	67	0	17	16	18	39	18·2	1·4	39·0

White Clover and its Impurities.

Some attention has been focused lately on New Zealand white clover in Britain through attempts by dealers to substitute New Zealand seed for Kentish wild white. A study made by the British authorities showed that *Silene gallica* (catchfly) associated with *Anagallis arvensis* (scarlet pimpernel) were the most commonly occurring impurities in New Zealand white-clover seed, and they are thus used as the main indicators. In this connection the data shown in Table 9 were prepared at this Station, and are presented here for their value in demonstrating the constant degree of occurrence of the various impurities from year to year. The figures under the heading of "Indices of Constancy" are the number of samples in each 100 examined which contained the individual impurity. The column "Wild White" under 1927 refers only to samples definitely labelled "New Zealand Wild White," and these figures may be taken as being truly indicative for New Zealand white clover.

Table 9.—Impurities of Commercial Seeds of White Clover for 1925, 1926, and 1927, with Indices of Constancy.

Species.	Indices of Constancy.			
	1925.	1926.	1927.	
	All Samples.	All Samples.	All Samples.	N.Z. Wild White.
Commercial Seeds.				
Trifolium dubium (suckling-clover) ..	89	87	94	100
Trifolium hybridum (alsike)	87	77	84	83
Trifolium pratense (red clover) ..	62	76	65	59
Phleum pratense (timothy)	38	35	35	45
Holcus lanatus (Yorkshire fog) ..	23	20	28	13
Medicago lupulina (English trefoil) ..	21	34	26	20
Lolium spp. (rye-grass (kernels)) ..	15	17	28	32
Cynosurus cristatus (crested dogstail) ..	9	3	8	8
Agrostis spp.	6	4	4	3
Poa pratensis	6	8	6	3
Dactylis glomerata (cocksfoot) ..	4	2	..	1
Lotus major	4	6	2	4
Phalaris spp. (kernels)	..	..	1	2
Weed-seeds.				
Rumex acetosella (sorrel)	92	79	87	90
Plantago lanceolata (rib-grass) ..	66	79	75	69
Chenopodium album (fat-hen) ..	52	39	47	41
Anagallis arvensis (scarlet pimpernel)	51	45	54	48
Silene gallica (catchfly)	31	26	34	31
Stellaria media (chickweed)	30	29	15	14
Vulgare prunella (selfheal)	24	18	11	13
Cerastium vulgatum (mouse-eared chickweed)	23	20	18	4
Sisymbium officinale (hedge mustard) ..	20	15	16	3
Spergula arvensis (spurrey)	17	14	13	15
Trifolium arvense (haresfoot trefoil) ..	16	15	13	12
Plantago major (broad-leaved plantain)	10	14	4	3
Polygonum aviculare (wireweed) ..	8	2	1	3
Cuscuta trifolii (dodder)	8	6	1	3
Anthoxanthum odoratum (sweet vernal)	5	2	2	2
*Silene noctiflora (night-flowering catchfly)	5	7	4	..
Rumex crispus (curled dock) ..	5	9	6	7
Sherardia arvensis (field madder) ..	5	12	13	3
*Crepis capillaris (hawkweed) ..	5	6	4	..
*Veronica buxbaumii (speedwell) ..	4	1	2	..
*Anthemis arvensis (chamomile) ..	2	4	1	..
*Geranium pusillum (small-flowered cranesbill)	2	10	2	..
*Myosotis arvensis (forget-me-not) ..	2	3	2	..
Trifolium glomeratum (clustered clover)	..	9	4	6
Atriplex sp. (orache)	2	2	5	3

* Indicators for imported seed.

ROOTS AND CRUCIFEROUS FORAGES.

The average germination figures for this class are shown in the following table:—

Table 10.—Average Germination of Roots and Cruciferous Forages, 1927.

Figures in parentheses in second column are 1926 averages.

Species.	Germination.			Percentage of Samples germinating between					
	Average.	Highest.	Lowest.	0-49.	50-59.	60-69.	70-79.	80-89.	90-100.
Turnips ..	83 (88)	100	7	3	3	9	15	34	36
Swedes ..	81 (83)	100	11	2	2	10	21	29	36
Rape ..	89 (87)	100	30	2	2	5	5	26	65
Kale ..	80 (82)	98	15	3	5	8	16	31	37
Chou moellier	76 (82)	97	47	2	14	29	9	29	21
Mangolds ..	83 (78)	94	39	3	10	15	21	42	9
Carrots ..	60 (65)	97	14	21	24	28	15	10	2

VEGETABLE-SEEDS.

Of the 280 samples of vegetable-seeds tested, 90 per cent. were up to standard quality, average germination percentages being as follows: Peas, 95; beans, 94; broccoli, 73; cauliflower, 73; cabbage, 76; celery, 60; cucumber, 94; leek, 62; onion, 72; lettuce, 95; marrow, 60; pumpkin, 88; parsnip, 58; radish, 81; spinach, 56; tomato, 88.

CEREALS AND MISCELLANEOUS FORAGES.

The average germination percentages of those seeds forwarded for testing were: Japanese millet, 81; barley, 91; oats, 93; rye-corn, 86; wheat, 91; tares, 70; maize, 87.

"Cheap" Pasture Mixtures.

Samples of a number of so-called cheap mixtures were received from farmers during the year for testing and examination. With few exceptions these were found to be very poor in quality and of an actual value much below the price asked. Outstanding examples are given in Table 11 (next page).

Mixture No. 1 costs 7d. per pound, is worth 3d., and could be replaced in first-grade seed, minus 3 per cent. weeds (18 species including 350 seeds of Californian thistle per pound), for approximately 8d. per pound.

Mixture No. 2 costs 5½d., is worth 2¾d., and could be replaced in first-grade seed, minus the weed-seeds, for approximately 7d. per pound.

Mixture No. 3 costs 1s., is worth 6d., and could be replaced for 11d. per pound. It contains dodder at the rate of 300 seeds per pound.

During the recent bush-burning season many tons of the above class of mixtures have been sown in the North Island. The mixtures themselves are quite good in appearance, and are in fact reasonably clean

for seconds, but the price in nearly every case is far in excess of the true value.

Table 11.—Examples of "Cheap" Pasture Mixtures.

Constituents.	Analysis of "Cheap" Mixture.				Same Mixture in First-quality Seed.	
	Percentage of Mixture.	Germination Percentage.	Value per Pound of each Constituent.	Value of each Constituent in 1 lb. of Mixture.	Cost of each Constituent in 1 lb. of Mixture.	Cost per Pound of each Constituent.
Pasture Mixture No. 1: Price, 7d. per Pound.						
			d.	d.	d.	
Rye-grass	60·0	49	2·6	1·56	2·70	4½d.
Cocksfoot	3·5	18	3·6	0·12	0·50	1s. 2d.
Crested dogstail ..	5·7	20	3·5	0·20	0·90	1s. 4d.
Chewings fescue ..	2·4	0	..	..	0·28	1s. 0d.
Cow-grass	14·0	15	2·7	0·37	2·24	1s. 4d.
White clover	4·6	67	11·3	0·51	0·74	1s. 4d.
Suckling-clover.. ..	3·0	48	3·4	0·10	0·18	6d.
Other commercial seeds ..	3·0	..	0·3	0·09	0·30	10d.
Weed-seeds	3·0	..	..	..	..	..
Inert matter	0·8	..	..	..	..	..
Totals ..	..	..	..	2·95	7·84	..
Pasture Mixture No. 2: Price, 5½d. per Pound.						
Rye-grass	60·0	54	2·8	1·93	3·10	4½d.
Crested dogstail ..	3·4	20	3·5	0·12	0·54	1s. 4d.
Cocksfoot	2·0	21	2·8	0·08	0·28	1s. 2d.
Cow-grass	12·4	13	2·3	0·28	2·00	1s. 4d.
White clover	1·8	66	11·1	0·20	0·28	1s. 4d.
Other commercial seeds ..	4·8	..	0·5	0·02	0·48	10d.
Weed-seeds	4·0	..	..	..	..	..
Inert matter	2·0	..	..	..	..	..
Totals ..	..	..	..	2·63	6·68	..
Clover Mixture: Price, 1s. per Pound.						
Cow-grass	35·0	32	5·5	1·9	5·25	1s. 4d.
White clover	25·5	57	9·6	2·5	3·62	1s. 4d.
Suckling-clover.. ..	20·5	62	4·5	0·9	0·82	6d.
English trefoil	11·2	54	4·8	0·5	0·90	8d.
Other commercial seeds ..	0·8	..	0·3	0·1	0·30	10d.
Weed-seeds	4·0	..	..	..	..	..
Inert matter	3·0	..	..	..	..	..
Totals ..	..	..	..	5·8	10·8	..

Acknowledgment is made of the computation of the figures in this record by Mr. W. J. Cooch and Miss E. Green, of the Seed-station staff.

Meat Industry Research.—It is reported that negotiations are practically complete for the formation of a freezing companies' research association by the majority of the New Zealand companies. Useful information already has been collected from the United States and Britain as to the treatment of pelts.

WHEAT-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1927-28.

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THE co-operative experiments on wheat-manuring conducted in Canterbury during the past season, while continuing certain of the objects of previous years, were designed to settle certain fundamental questions as a forerunner to systematic extension of problems depending upon the basic ones. Following are examples of these fundamental questions :—

(1) What is the best form of phosphate for wheat ? Before work on the best-paying quantity of fertilizer is carried out this question must be settled. Obviously it is desirable to find out how much of an already determined best kind of phosphate to apply, rather than to attempt to ascertain what is the best quantity of a particular phosphate to apply without knowing whether it is the best kind or not.

(2) Does potash influence the yield ? In the past, ½ cwt. of potash per acre has been used with, on the whole, no beneficial results. Is ½ cwt. per acre sufficient to enable this question to be answered ? Certainly 1 cwt. per acre should give a decisive answer, and the larger quantity is now being used.

(3) Does nitrogen justify its use ? Dried blood, a form of nitrogen recognized as not so efficient as forms such as nitrate of soda and sulphate of ammonia, has been used mostly in the past. Its paying use has been rather doubtful, while the other two forms of nitrogen have generally shown better results where used. Consequently the present work on nitrogen is being carried out with nitrate of soda at 1 cwt. per acre, a quantity considered sufficient to give a decisive answer as to whether nitrogen is of value or not.

If potash and nitrogen prove to be of paying use, the best quantity and—particularly in the case of nitrogen—the best time to apply are problems which will require solution.

Seven of the main wheat-growing counties—Eyre, Rangiora, Paparua, Malvern, Ashburton, Geraldine, and Waimate—were selected, and two experiments were conducted on a single farm in each district. The experiments are here designated " A " and " B," so that there was an A and a B experiment on each of the seven farms.

MANURIAL TREATMENTS USED.

These were as follows, the quantities given being at per-acre rate :—

Experiment A—

(1) No manure.	
(2) Superphosphate (44/46 per cent. tricalcic phosphate)	1 cwt.
(3) Basic super (41/43 per cent. tricalcic phosphate)	1 cwt.
(4) Ephos phosphate (guaranteed 54 per cent. tricalcic phosphate) ..	1 cwt.
(5) Nauru phosphate (about 80 per cent. tricalcic phosphate) ..	1 cwt.

Experiment B—

(1) Superphosphate	1 cwt.
(2) Superphosphate 1 cwt., plus muriate of potash 1 cwt.	2 cwt.
(3) Super 1 cwt., plus nitrate of soda 1 cwt.	2 cwt.
(4) Super 1 cwt., plus muriate of potash 1 cwt., plus nitrate of soda 1 cwt.	3 cwt.

The nitrate of soda was applied as a top-dressing in September. All treatments were replicated ten times, and each plot was divided into two or three at harvest, giving from twenty to thirty determinations of yield. (The method of doing this work is described in the *Journal* for July, 1926, p. 6.) Solid-straw Tuscan was the variety used in every case, except at R. Patrick's farm, Willowbridge.

NOTES ON TABLES.

All results have been submitted to statistical examination. The differences between the treatments and the control plots are shown in heavy type when these differences are "significant." If the differences are "non-significant," the letters "N.S." are inserted. A difference is said to be significant when the chances as shown by statistical examination are greater than 30 to 1 in its favour. Hence it can be said that a significant difference is one about which there can be no doubt. A non-significant difference, on the other hand, may be real enough, but it is too unreliable to be viewed with confidence.

In Tables A the no-manure plot is used as the control for comparative purposes. Where superphosphate gives a significantly better yield than the other phosphates the fact is mentioned in the comments on the tables.

In Tables B the superphosphate is used as the standard with which the other treatments are compared. As Experiments A and B were immediately alongside each other on each farm it is reasonable to suppose that the super in Experiment B would have given about the same increase over no-manure plots, had these been included, as it did in the adjoining experiment. Hence the net profit or loss shown by super in the A tables is carried down to the B tables, and forms the basis for comparison of return when potash and nitrogen are added to super.

In all tables net profit is estimated—on a basis of 5s. per bushel for wheat—as the increased monetary return after paying for manure at the following prices: Super, 5s. 9d. per cwt.; basic super, 5s. 3d.; Ephos phosphate, 6s. 6d.; Nauru phosphate, 5s. 6d.; muriate of potash, 16s.; nitrate of soda, 18s.

(1) Experiments on Farm of C. McIntosh, Horrelville (Eyre).

The paddock chosen had been in peas the previous season and in grass for two years before that. The plots were sown on 18th and 19th May, 1927, and harvested on 8th February, 1928.

During the growing-period August to October the superphosphate and basic super plots were slightly superior in growth to the remainder of the plots. Differences were most difficult to detect, with the exception of the plots on the B experiment, where the superphosphate drills showed up well ahead a few weeks after sowing. The potash and super mixture delayed germination, and depressed it to the extent of about 15 per cent. as compared with super alone. The nitrate of soda in the B experiment was applied on 26th September. The results are shown in Tables 1A and 1B.

Table 1A.

(Each yield is the average of 18 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) No manure	52·9	..	..
(2) Superphosphate	55·5	2·6	Profit, 7s. 3d.
(3) Basic super	55·7	2·8	Profit, 8s. 9d.
(4) Ephos phosphate	54·9	2·0	Profit, 3s. 6d.
(5) Nauru phosphate	53·9	1·0	Loss, 6d.

Comments on Table 1A: While the increases are small, they fully justify the use of three out of four of the manures.

Table 1B.

(Each yield is the average of 18 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) Superphosphate	58·2	..	Profit, 7s. 3d. (see Table 1A).
(2) Super plus muriate of potash ..	57·4	N.S	Loss, 8s. 9d.
(3) Super plus nitrate of soda ..	61·3	3·1	Profit, 4s. 9d.
(4) Super plus potash and nitrate of soda	61·8	3·6	Loss, 8s. 9d.

Comments on Table 1B: Super is reckoned to carry the profit, as shown in Table 1A. (The same procedure was adopted with other experiments, except No. 7.) The addition of potash to super has had no effect on yield, and the use of the mixture has resulted in a loss of 8s. 9d. per acre. Although nitrate of soda has given a substantial increase of just over 3 bushels per acre, this has not been sufficient to meet the cost of the dressing, and the profit is reduced to 4s. 9d. per acre. The superphosphate, potash, and nitrogen application shows a oss of 8s. 9d. per acre.

(2) Farm of Guy Bros., Fernside (Rangiora).

At Fernside a paddock having grown peas in the preceding season, and wheat, peas, and grass prior to that, was selected. The plots were sown on 26th and 27th May, 1927, and harvested on 30th January, 1928.

The superphosphate and basic super plots in Experiment A showed slightly better growth but lighter colour than the remainder. As will be seen from Table 2A, the growth appearance did not indicate the yield differences. Here again potash in combination with super markedly depressed early growth, and germination again suffered to the extent of 16·5 per cent. The nitrate of soda was applied on 19th September, and, in spite of an already vigorous dark-green crop, it increased

growth and deepened the colour to a noticeable extent within a month of application. The results are given in Tables 2A and 2B.

Table 2A.
(Each yield is the average of 11 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) No manure	60·2	..	..
(2) Superphosphate	60·6	N.S.	Loss, 5s. 9d.
(3) Basic super	59·5	N.S.	Loss, 5s. 3d.
(4) Ephos phosphate	59·2	N.S.	Loss, 6s. 6d.
(5) Nauru phosphate	60·0	N.S.	Loss, 5s. 6d.

Comments on Table 2A: None of the phosphates affected the yield to a significant extent. This was rather surprising in view of the growth differences in the early stages. The results do not appear to conform to the general experience on this land in other seasons, but certainly they are true enough for the paddock and season under review.

Table 2B.
(Each yield is the average of 15 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) Superphosphate	62·4	..	Loss, 5s. 9d.
(2) Super plus potash	64·7	**2·3**	Loss, 10s. 3d.
(3) Super plus nitrate of soda ..	73·5	**11·1**	Profit, £1 1s. 9d.
(4) Super plus potash plus nitrate of soda	71·0	**8·6**	Profit, 3s. 3d.

Comments on Table 2B: The addition of potash to super has caused an increase in yield of 2·3 bushels per acre, which is not sufficient to pay for the costly application. The initial depressing effect of the potash on germination does not correspond with the effect on the yield. Nitrate of soda, which looked markedly superior before the harvest, has caused a very considerable and profitable increase of just over 11 bushels per acre, and a resultant profit of £1 1s. 9d. from the use of the phosphate and nitrate. Whether the nitrate applied to crops not already dressed with phosphate would have brought about such an increase is problematical. The complete fertilizer treatment does not show as good a yield as the treatment just mentioned, and the profit is only 3s. 3d. per acre.

(3) Farm of F. W. Carpenter, Prebbleton (Paparua).

The previous crop on the paddock selected was potatoes, and for four years prior to the potato crop the paddock was in grass. The plots were sown on 6th and 7th July, 1927, and harvested on

TYPICAL PLOTS ON CARPENTER'S FARM.

From left to right the pegs are marked (1) No manure, (2) basic super, (3) super, (4) Ephos, (5) Nauru. Note superior growth of basic super and super plots. Photo taken about 29th September, at which stage nitrate of soda was applied to the adjoining Experiment B.

[*Photo by E. M. Bates.*

6th February, 1928. From 30th August onwards the super and basic super plots in Experiment A showed a marked superiority in growth (see photo). Plots receiving potash in Experiment B showed a definite though slight retardation in growth just after coming through the ground. Counts of plants showed no difference in the actual number of seeds germinating. Nitrate of soda was applied on 28th September, and its effect on colour and growth began to be apparent three weeks later. The yields are shown in Tables 3A and 3B.

Table 3A.

(Each yield is the average of 20 plots.)

Treatment.	Bushels per Acre. Yield.	Bushels per Acre. Difference.	Net Profit or Loss per Acre.
(1) No manure	62·7	..	..
(2) Superphosphate	70·8	**8·1**	Profit, £1 14s. 9d.
(3) Basic super	69·3	**6·6**	Profit, £1 7s. 9d.
(4) Ephos phosphate	65·6	**2·9**	Profit, 8s.
(5) Nauru phosphate	66·5	**3·8**	Profit, 13s. 6d.

Comments on Table 3A: Superphosphate has given a very considerable increase of 8·1 bushels per acre, with a net profit of £1 14s. 9d. Although the other phosphates have paid, the superphosphate yield is significantly higher than all others.

Table 3B.

(Each yield is the average of 18 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) Superphosphate	76·7	..	Profit, £1 14s. 9d.
(2) Super plus potash	72·4	- 4·3	Loss, 2s. 9d.
(3) Super plus nitrate of soda ..	81·8	5·1	Profit, £2 2s. 3d.
(4) Super plus potash plus nitrate of soda	77·2	N.S.	Profit, 9d.

Comments on Table 3B: Potash has caused a definite and significant depression in yield. Treatment 2 is less than treatment 1 by over 4 bushels per acre, and treatment 4 is less than treatment 3 by about the same amount. The effect on the financial aspect is highly unsatisfactory. On the other hand, the use of nitrate of soda has increased the yield to a paying extent. This is the third season in succession that nitrate of soda has given between 5 and 6 bushels per acre increase on this farm.

(4) Farm of D. Gillanders, Darfield (Malvern).

A wheat crop preceded the experimental sowings on this paddock, which had previously to that been in grass for four years. The dates of sowing the plots were 24th and 25th May, 1927.

As in the case of all the other experiments, no differences were visible just after the crop came through, but in early September the superphosphate and basic super plots showed a marked superiority in growth over the Nauru and Ephos plots, which themselves were quite superior to the no-manure plots. The differences persisted until just before the crops came into ear, and after this differences were hard to detect. In Experiment B the delayed growth on the plots receiving potash was very marked, but counts revealed no difference in the actual number of seeds germinating. About three weeks after the application of nitrate of soda, on 29th September, its effect was much in evidence, and a marked superiority continued to the end of the growing-period. Tables 4A and 4B indicate the results.

Table 4A.

(Each yield is the average of 26 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) No manure	40·2	..	..
(2) Superphosphate	45·1	4·9	Profit, 18s. 9d.
(3) Basic super	42·8	2·6	Profit, 7s. 9d.
(4) Ephos phosphate	42·7	2·5	Profit, 6s.
(5) Nauru phosphate	43·4	3·2	Profit, 10s. 6d.

Comments on Table 4A: All treatments show a paying increase over no-manure. Super has proved the most paying form of phos-

phate, and has given a highly significant increase over the other three phosphates.

Table 4B.

(Each yield is the average of 22 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) Superphosphate	45·4	..	Profit, 18s. 9d.
(2) Super plus potash	47·1	**1·7**	Profit, 11s. 3d.
(3) Super plus nitrate of soda ..	54·5	**9·1**	Profit, £2 6s. 3d.
(4) Super plus potash plus nitrate of soda	51·3	**5·9**	Profit, 15s. 3d.

Comments on Table 4B: Although potash added to super has caused an increase of 1·7 bushels over the super yield, it has not proved paying, reducing the net profit to 11s. 3d. per acre. The super and nitrate-of-soda combination has proved greatly superior to super alone, with a resultant net profit of £2 6s. 3d. per acre. Treatment 4, while showing a considerable increase over super, has not yielded as well as treatment 3. The difference between treatment 3 and treatment 4 of 3·2 bushels is highly significant. This reduction in yield to below the super-plus-nitrogen yield when the potash is used in conjunction with super and nitrate of soda is difficult to account for, and as the same thing has occurred in several other experiments this season a further note is made on it later (page 349).

(5) Farm of J. McAnulty, Methven (Malvern).

The area selected for this experiment was in a paddock which had been in grass for six years before. The plots were drilled on 10th and 11th June, 1927, and harvested on 13th February, 1928.

At no stage in growth did the plots in Experiment A show any marked differences, although a careful examination revealed a slightly better growth on the super and basic super plots from September to December. On Experiment B the plots were very uniform in growth—there being no adverse effect from potash—until three weeks after the application of nitrate of soda, when a distinct though slight effect was in evidence. The nitrate was applied on 27th September. Yields are given in Tables 5A and 5B.

Table 5A.

(Each yield is the average of 22 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) No manure	67·7	..	..
(2) Superphosphate	74·9	**7·2**	Profit, £1 10s. 3d.
(3) Basic super	75·0	**7·3**	Profit, £1 11s. 3d.
(4) Ephos phosphate	71·3	**3·6**	Profit, 11s. 6d.
(5) Nauru phosphate	68·3	N.S.	Loss, 5s. 6d.

Comments on Table 5A: Super and basic super have each given practically equal and highly-paying increases over no-manure to the extent of more than 7 bushels. Nauru phosphate has failed to establish a significant increase in yield. Both super and basic super are significantly better than Ephos and Nauru.

Table 5B.

(Each yield is the average of 20 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) Superphosphate	68·8	..	Profit, £1 10s. 3d.
(2) Super plus potash	69·7	N.S.	Profit, 14s. 3d.
(3) Super plus nitrate of soda ..	74·2	**5·4**	Profit, £1 19s. 3d.
(4) Super plus potash plus nitrate of soda	73·2	**4·4**	Profit, 18s. 3d.

Comments on Table 5B: No significance can be attached to the slight increase of super plus potash over the super alone, and the use of the potash must be regarded as a loss, thereby reducing the net profit to 14s. 3d. per acre. The increase due to nitrate of soda of nearly 5½ bushels per acre is quite a paying one, and the net profit of £1 19s. 3d. per acre is quite handsome. The failure of potash in the fourth treatment again reduces the profit.

(6) Farm of J. Topham, Arowhenua (Geraldine).

The crops preceding the wheat experimental plots were potatoes, white-clover, and wheat. The plots were sown on 13th and 14th July, 1927, and harvested on 17th February, 1928. The crop looked remarkably well throughout, and in Experiment A there appeared to be a slight stimulation in growth on the super and basic super plots. In Experiment B the nitrate was applied on 29th September, but no appreciable effect could be detected. The results are given in Tables 6A and 6B.

Table 6A.

(Each yield is the average of 21 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) No manure	59·7	..	..
(2) Superphosphate	60·2	N.S.	Loss, 5s. 9d.
(3) Basic super	60·1	N.S.	Loss, 5s. 3d.
(4) Ephos phosphate	59·7	N.S.	Loss, 6s. 6d.
(5) Nauru phosphate	59·3	N.S.	Loss, 5s. 6d.

Comments on Table 6A: None of the manures has caused a significant increase in yield over no-manure.

Table 6B.

(Each yield is the average of 26 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) Superphosphate	61·3	..	Loss, 5s. 9d.
(2) Super plus potash	62·9	**1·6**	Loss, 13s. 9d.
(3) Super plus nitrate of soda ..	65·6	**4·3**	Loss, 2s. 3d.
(4) Super plus potash plus nitrate of soda	63·7	**2·4**	Loss, £1 7s. 9d.

Comments on Table 6B: All treatments (2, 3, and 4) show better yields than super, but, with the exception of treatment 3, the losses are greater than that when super alone was used. It should be noted that the nitrate-of-soda increase of 4·3 bushels is worth £1 1s. 6d., which is more than sufficient to pay for 18s. worth. Hence the loss is occasioned by the super. Of course, it is not certain that the nitrate alone would have given so big an increase. Potash and nitrate as single additions to the super (treatments 2 and 3) give increases, but potash used in conjunction with super and the nitrate (treatment 4) has not been beneficial. The difference between Plots 3 and 4 is significant. The similarity to Table 4B should be noted.

(7) Farm of J. Patrick, Willowbridge (Waimate).

On this farm Experiment A followed rape in the rotation, and Experiment B followed wheat on the same paddock, which had previously been in barley and green feed (oats). Unfortunately, the crop in Experiment A lodged so badly as to preclude the possibility of cutting the plots, and the experiment had to be abandoned. At no stage during growth could differences be detected. On Experiment B the potash plots displayed a little of the delayed growth typical of most of the northern experiments. The nitrate of soda was applied on 6th September, with no perceptible later effects. As Experiment A had to be abandoned, information regarding phosphates is not available, and no profit or loss is shown against super in Experiment B.

Table 7B.

(Each yield is the average of 22 plots.)

Treatment.	Bushels per Acre.		Net Profit or Loss per Acre.
	Yield.	Difference.	
(1) Superphosphate	38·4	..	..
(2) Super plus potash	37·2	N.S.	Loss, 16s.
(3) Super plus nitrate of soda ..	37·6	N.S.	Loss, 18s.
(4) Super plus potash plus nitrate of soda	40·9	**2·5**	Loss, £1 1s. 6d.

Comments on Table 7B: This table presents an interesting state of affairs. All additions to the phosphates have shown a loss, and

although potash and nitrogen individually added to super (treatments 2 and 3) show no increase, when all three are applied a definite and significant increase is registered. This, however, is far from being paying.

General Remarks and Summary.

The season was particularly favourable for wheat-growing, with, generally speaking, ample rainfall without any very serious overwet periods. The large yields evidence the excellence of the season.

PHOSPHATES.

Four out of the seven experiments show paying increases from the use of phosphates. Experiments 2, 6, and 7, where no phosphate response occurred, do not necessarily indicate that the districts in which these experiments were conducted are not responsive to phosphates. All that they tell us is that in the season of trial the areas selected did not respond. Further work in future seasons will enable a determination to be made of whether the present season's results are typical or not.

SUPERPHOSPHATE AND BASIC SUPER.

These did not differ significantly in Experiments 1 and 5 (Tables 1A and 5A), but super established a definite superiority over basic super in Experiments 3 and 4 (Tables 3A and 4A). Superphosphate proved superior to Ephos and Nauru in Experiments 3, 4, and 5, and though the difference is not statistically significant in Experiment 1 it points in the same direction.

It should be noted that, as in previous years, the greater the effect of phosphates in increasing yield the earlier the stage of ripening. Experience has shown that where phosphate-treated cereals ripen before untreated a sure indication of an increase from the phosphate is obtained, although it does not follow that there is no increase where maturity is not hastened from the use of phosphates. Unfortunately, however, most farmers view early maturity as what is commonly called "blighting-off."

NITRATE OF SODA.

The crops most likely to respond to spring application of soluble nitrogenous fertilizer are those showing the all-to-common light-green to yellowish-green colour.

In selecting areas for the experiment no attempt was made to select paddocks likely to specially respond to nitrogen, and it is surprising that such good response should have been obtained on some of these fields. It is highly improbable that the high nitrogen response is altogether due to the peculiarities of the season, because this is the third year in succession that an increase of between 5 bushels and 6 bushels per acre has occurred on Mr. Carpenter's farm at Prebbleton (see *Journal* for September, 1927, p. 187, and August, 1926, p. 111) as a result of using nitrogen in the spring.

In addition to the foregoing experiment, Mr. Kennedy, of Springbank, Mr. Spence, of Mitcham, and Mr. H. Wilkinson, of Chertsey, all on lighter wheat-land, used nitrate of soda on small plots at the

Department's request. On the two first-mentioned farmers' paddocks the response was remarkable, and must have been between 10 bushels and 15 bushels per acre. There was a definite response on the last-mentioned farm also, but the plot was not inspected just before harvesting, and no close estimate could be formed of the result. Next spring the Department intends to conduct a comprehensive further trial and demonstration of the use of soluble nitrogen as a spring top-dressing for cereals.

POTASH.

Considerable diversity of results occurred with the use of potash. In five of the experiments there was an early retardation of growth, and in two of them definite harm to germination to the extent of 15 to 17 per cent. took place. The effect on yield did not correspond with the early effect on growth. In one experiment (3B) potash caused a definite depression in yield to the extent of over 4 bushels per acre when used with superphosphate on the one hand and with super plus nitrate of soda on the other. In three experiments (2B, 4B, and 6B) potash added to super gave significant though non-paying increases. In all three nitrate of soda added to super gave paying increases, but potash in combination with super and nitrate of soda showed a considerably lower yield than super plus nitrate. Two of these latter were highly significant, and the third, though non-significant, was no doubt real enough.

The same order of things is apparent in Experiment 5B, although the potash-plus-super increase and the potash-plus-super-plus-nitrate decrease, as compared with super plus nitrate, are not significant. The writers can offer no reason for this behaviour of the manures. There is not sufficient evidence from these experiments to warrant the recommendation of the use of potash on wheat.

The valuable co-operation and assistance so willingly given by farmers is much appreciated, and the assistance of Messrs. Hardy, Elliott, and Leitch, of the Fields Division's staff, is duly acknowledged. The muriate of potash used in the experiments was kindly supplied free of charge by Dalgety and Co., Ltd., Christchurch.

Noxious-weeds Order.—The Peninsula County Council (Otago) has declared hemlock, burdock, gorse, and broom as noxious weeds, and Californian thistle as not a noxious weed, within that county.

The Ragwort Moth.—At the April meeting of the Council of Scientific and Industrial Research the Acting-Chairman stated that after extended trials it had been decided by the Noxious Weeds Committee that a restricted permit only should be issued for the release of the ragwort moth *Tyria jacobaeae*. It was considered necessary to take the utmost precautions regarding all insect releases; hence *Tyria jacobaeae* was placed out on ragwort areas in the immediate vicinity of the Cawthron Institute only. In the event of its ultimate safety being thoroughly proved, this action will render a large supply of insects available for more extended release next season. It is hoped that the outbreak of wilting-disease which has appeared, probably as a result of the restriction of the moths to a confined feeding-area, will not seriously diminish the number which will winter over and be available for release, if such a course is decided upon, at a later date.

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, 1927–28 SEASON.

J. W. DEEM, Instructor in Agriculture, Wanganui.

THE autumn and winter of 1927 were very wet at Marton, and consequently difficult for agricultural operations, which had to be delayed until late spring. Work then had to be rushed, as the weather set in dry, and the heavy soil rapidly went hard and cracked. The rainfall recorded locally for the twelve months April, 1927, to March, 1928, inclusive, totalled 34·47 in., compared with 49·51 in. during the preceding year, and an average over twenty years of about 40 in.

Heavy rain in November (6·36 in.) gave both crops and pastures a great push, and carried them on well to Christmas, after which the district experienced the prevailing abnormally dry summer, with practically no growth.

CLOVERS AND GRASSES.

The various strains of white clover under experimentation continue to give interesting results. The imported Kentish wild white and the Canterbury (N.Z.) white have produced a wonderful sward, the whole area being pure clover, whereas the ordinary imported white adjoining, sown on the same day and under the same conditions, has nearly died out, the ground having become badly infested with grass, chiefly *Agrostis stolonifera* (water-couch or creeping-bent). While the Kentish and Canterbury clovers are both excellent, there is no doubt that the former is the superior; it appears to come away rather quicker, and also has a greater spreading habit. As in previous seasons, the Kentish clover has produced very few flowers.

In the red-clover trials Montgomeryshire Late Cut continues to give the best cover. It was hoped to get some seed this season, but owing to the extremely dry weather there was very little second growth, and only a small quantity was saved. This has lately been sown in another field. A further quantity of genuine Montgomeryshire seed has been received from Britain, and will be sown in a 10-acre field next spring for seed purposes. The New-Zealand-grown red clover is still doing well, but the ordinary imported red has practically died out, although only in its second year.

Trials between genuine Hawke's Bay old-pasture perennial rye-grass and South Island standard seed have been continued, and extended to include Sandon rye-grass. So far the superiority of the Hawke's Bay seed is very marked.

PALATABILITY AND PASTURE-MANAGEMENT.

In December, 1924, a field was sown in two strains of white clover, these being divided by a ½-chain strip of Phalaris bulbosa (perennial canary-grass). The whole area has been treated alike, simply grazed by sheep, and no top-dressing has been done. From the beginning the clovers were relished by the stock and kept in good order, while the phalaris area was neglected, with the result that rushes appeared on it. This development has afforded a noteworthy example of the

FIG. 1. ONE OF THE WHITE CLOVER TRIAL AREAS AT MARTON.

In foreground—plot sown in ordinary imported white, now almost run out and land infested with Agrostis stolonifera. in background plots of Canterbury white and Kentish wild white in thriving condition.

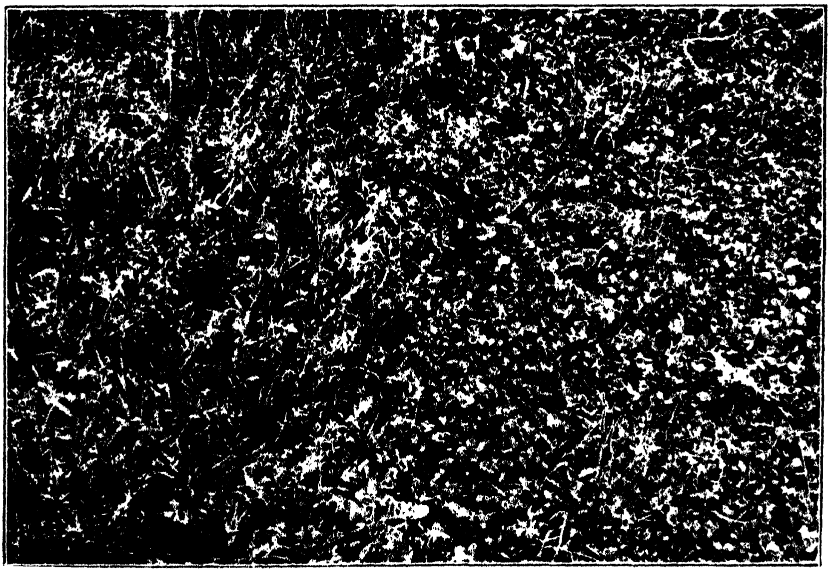

FIG. 2. CLOSE-UP VIEW ON DIVIDING LINE OF CLOVER PLOTS SHOWN IN FIG. 1.

On left—run-out ordinary imported white; on right—Canterbury white.

[*Photos by H. Drake.*

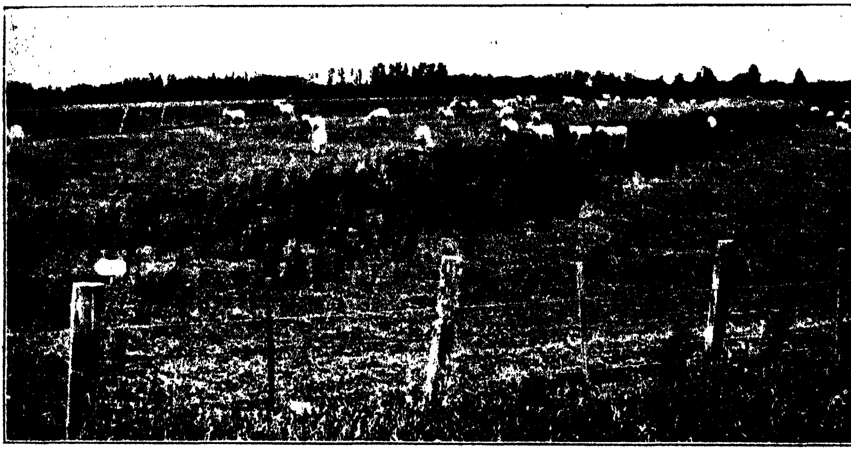

FIG. 3. EXAMPLE OF EFFECT OF UNPALATABLE PASTURE.

In centre – strip sown in Phalaris bulbosa, neglected by stock and now rush-infested. To right and left — plots of white clover, well grazed and in good condition. *Photo by H. Drake.*

incidence of palatability and the necessity for proper pasture-management. Fig. 3, reproduced from a photograph taken three years after sowing, gives a fair idea of the present state of the area. Prior to sowing in clovers and grasses in 1924 this piece of land had been under cultivation for several years, growing grain, fodder crops, peas, and roots, a root crop coming last.

PASTURE TOP-DRESSING.

The experiments referred to in last year's report (*Journal*, September, 1927) have been continued, and a further area, known as Follet's section, has been treated. This area is a continuation of the same type of land as that known as Brice's section, and has been down in grass for probably thirty years. The covering at time of treatment consisted almost entirely of Agrostis stolonifera and sedges. Particulars are given below (1) of trials on part of Field 4 between superphosphate and Seychelles "guano," and (2) of a test between the same phosphatic manures plus potash. It will be noted that the addition of the potash gave a slight increase over the phosphatic dressings alone. This is the first time that potash has given an increase at the Marton Area. All dressings were repeated several times, and the weighing carefully done on the approved method.

(1) Manure applied, 23/7/27; field closed, 15/9/27; material weighed, 5/12/27.
Superphosphate, 44/46 per cent., 3 cwt. per acre. Green material cut, 9·4 tons per acre.
Seychelles guano, 3 cwt. per acre. Green material, 9·13 tons per acre.

(2) Manure applied, 23/7/27; field closed, 15/9/27; material weighed, 5/12/27.
Super, 3 cwt. per acre. Green material, 9·73 tons per acre.
Super, 3 cwt., and muriate of potash, ½ cwt., per acre. Green material, 10·11 tons per acre.
Seychelles guano, 3 cwt. per acre. Green material 9·22 tons per acre.
Seychelles guano, 3 cwt., and muriate of potash, ½ cwt., per acre. Green material, 10·21 tons per acre.

Moss's Section, Field 4A.

This area was not top-dressed during the past season, but the plots were weighed to ascertain the lasting effects of the previous treatments. Table 1 gives the weights for the past season, for 1925 and 1926 combined, and for the total of the last three years. Interesting points are the good showing of basic slag, Nauru phosphate, and super, also super plus nitrate of soda. This latter area shows a wonderful recovery of cocksfoot and crested dogstail, while white clover is also doing well.

Table 1.

Plot No.	Treatment per Acre.	Grass Weight per Acre, 1927 Cut.	Grass Weight per Acre, 1925 and 1926 Cuts.	Total Weight per Acre, Three Cuts.
		Tons.	Tons.	Tons.
1	Carbonate of lime, ½ ton, applied 27/7/25	1·61	1·75	3·36
2	Control (no manure)	1·39	1·30	2·69
3	Carbonate of lime, ½ ton, 27/7/25; super, 3 cwt., 27/7/25, 28/5/26	3·97	6·10	10·07
4	Control	1·17	1·70	2·87
5	Super, 3 cwt., 27/7/25, 28/5/26 ..	4·62	4·90	9·52
6	Control	1·65	1·85	3·50
7	Basic super, 3 cwt., 27/7/25, 28/5/26	3·53	3·65	7·18
8	Control	1·96	1·50	3·46
9	Basic slag, 3 cwt., 27/7/25, 28/5/26 ..	4·75	5·85	10·60
10	Control	1·57	1·70	3·27
11	Nauru phosphate, 3 cwt., 27/7/25 ..	4·80	5·05	9·85
12	Control	2·14	1·90	4·04
13	Super and blood and bone (half-and-half), 3 cwt., 27/7/25, 28/5/26	3·62	3·70	7·32
14	Control	1·44	2·15	3·59
15	Super and blood and bone (half-and-half), 3 cwt., plus sulphate of potash, ¼ cwt.	4·75	4·40	9·15
16	Control	3·21	2·25	5·46
17	Super, 3 cwt., 27/7/25, 28/5/26, plus nitrate of soda, 1 cwt., 7/10/25, 13/10/26	6·15	7·18	13·33

The results of the addition of nitrate of soda to plot 17 suggested that nitrogenous manures should be further tested on this area. Accordingly strips ½ chain wide right across the phosphatic dressings were treated with nitrate of soda and sulphate of ammonia at the rate of 1 cwt. per acre. This was applied on 20th September, 1927, and the grass weighed on 29th December. Results were as follows:—

Average for sulphate of ammonia, 4·12 tons per acre. Increase, 1·41 tons.
Average for controls, 2·71 tons per acre.
Average for nitrate of soda, 3·43 tons per acre. Increase, 1·24 tons.
Average for controls, 2·19 tons per acre.

The increase in weight was due to stronger growth of rye-grass and dogstail.

Brice's Section, Field 3A.

This section was not top-dressed in the past season, but weighed again as usual. Table 2 is interesting as showing the building-up effects of the different fertilizers. It is not proposed to top-dress this area this season, but to weigh again next year and further test the lasting effect of the different fertilizers.

Table 2.

Plot No.	Treatment per Acre.	Green Weight per Acre, One Cut, 29/12/27.	Total Green Weight per Acre, Four Years, One Cut each Year.
		Tons.	Tons.
1	Carbonate of lime, 1 ton, 9/8/21; super, 2 cwt, 9/8/21, 11/8/24, 28/5/26	5·30	25·10
2	Bone-char, 4 cwt., 9/8/21; Nauru phosphate dust, 4 cwt., 11/8/24, 28/5/26	6·87	21·77
3	Walpole Island phosphate, 4 cwt., 9/8/21; Nauru phosphate, 4 cwt., 18/8/24, 28/5/26	7·33	21·63
4	Nauru phosphate, 4 cwt., 2/11/22, 11/8/24, 28/5/26	6·54	21·24
5	Control (no treatment)	1·56	5·12
6	Basic slag, 4 cwt., 14/7/21, 11/8/24, 28/5/26	5·10	18·05
7	Nauru phosphate, 4 cwt., 14/7/21, 11/8/24, 28/5/26	7·06	16·84
8	Ephos phosphate, 4 cwt., 14/7/21, 11/8/24, 28/5/26	7·86	18·66

Follet's Section.

This area was top-dressed for the first time on 30th July, 1927, all manures being applied at the rate of 3 cwt. per acre. Weighing was done on 29th December. A test was made between super, Seychelles guano, Nauru phosphate, and special Nauru. The latter consisted of the very fine dust collected at the crushing-works, and would be from 50 to 100 per cent. finer than the ordinary Nauru ground phosphate. This dust was used in order to ascertain whether extreme grinding was of any value with Nauru, and to check the results with those of a similar test made in the preceding year. There was also a test between superphosphate and sulfurophosphate. Results were as follows :—

	Green Weight per Acre Tons.	Increase over Control. Tons.
Super, 44/46 per cent...	5·76	3·67
Ordinary Nauru phosphate	4·06	1·97
Nauru dust	3·66	1·57
Seychelles guano	4·89	2·80
Controls	2·09	..
Super, 44/46 per cent.	6·19	3·88
Sulfurophosphate	4·74	2·37
Controls	2·37	..

OTHER PASTURE WORK.

The small grass-plots have been extended to include, among other grasses, a further sowing of Phalaris stenoptera from seed received direct from California, and Paspalum compressum. The Phalaris germinated well, but so far no plant of the paspalum has been noticed. There is nothing outstanding among the small plots to record, except perhaps a special strain of Danish cocksfoot which appears to be forming a very fine sward.

A 5-acre field has just been sown in various grasses, in order to form a link in certain grass-research work being conducted by Mr. E. Bruce Levy, the Department's Agrostologist.

CEREAL CROPS.

These consisted of 12 acres of Black barley, autumn-sown, and 5 acres each of wheat and barley, spring-sown. The autumn-sown barley was almost drowned out, and the crop did so poorly that it was decided to eat it off with sheep, as it would not have paid to harvest. The spring crops were fair. The wheat—Jumbuck variety—was grown alongside a plantation and suffered severely from bird depredation right up to date of threshing. The Spratt-Archer barley was sown very late, but both it and the wheat were good samples. The barley has been secured by farmers for growing in the district next year.

It may be mentioned here that Jumbuck wheat was introduced into the Marton district through the Experimental Area. This season most of the wheat grown in the district was Jumbuck, and, besides giving record yields, it is considered by the local miller to be the best locally grown wheat as to flour that he has ever put through the mill.

SEEDS IMPORTATION REGULATIONS.

The following regulations under the Seeds Importation Act, 1927—a summary of which measure was given in the *Journal* for December last—were gazetted on 28th April:

1. (1) These regulations may be cited as "The Seeds Importation Regulations, 1928."

(2) These regulations shall come into force on the date of publication in the *Gazette*, but shall not apply to any seed that may then be in transit by sea to the Dominion.

(3) For the purposes of these regulations, unless the context otherwise requires, "the said Act" means the Seeds Importation Act, 1927; "import" includes attempting to import or being concerned in importing; "seed" means cocksfoot (*Dactylis glomerata*), lucerne (*Medicago sativa*), or white clover (*Trifolium repens*) seed, or any other seed declared by the Governor-General in Council to be subject to the provisions of the said Act; "Inspector" means any person appointed as Inspector for the purposes of the said Act.

2. (1) Not less than one per centum of each package of seed imported into New Zealand shall be stained prior to importation with a red colouring-matter.

(2) The colouring-matter to be used shall be either an alcoholic solution of saffranin or a specially prepared and effective fluid seed-staining dye.

(3) Staining shall be done by mixing one per centum of the bulk with the stain and then blending the stained parcel with the bulk lot.

3. (1) The form of certificate required by subsection (2) of section 5 of the said Act shall be in the form set out in the First Schedule.

(2) The certificate shall be in duplicate. One copy shall be retained by the importer at the port of entry, and the other shall be supplied by him to the Inspector, who shall, on being satisfied that the seed covered by the certificate has been treated as prescribed in these regulations, issue a permit in the form set out in the Second Schedule for the seed to be landed.

4. The following shall be the only ports of entry for seed: Auckland, Wellington, Lyttelton, Dunedin, Port Chalmers, Bluff.

The schedules may be seen in the *Gazette*.

Milk By-products.—The question of economical evaporation of whey and buttermilk is now being studied under the auspices of the Research Council. Arrangements are in hand for special investigations to be carried out at the New Zealand Co-operative Dairy Co.'s laboratory, Hamilton, and at the Hawera Dairy Laboratory.

SEASONAL NOTES.

THE FARM.

WINTER FEEDING OF DAIRY COWS.

INADEQUATE winter feeding of cows is a common cause of low production in dairy herds. A cow calving in good condition and properly fed after calving will quickly reach her maximum production, whereas one calving in poor condition takes some time to reach her maximum yield of milk, for instead of converting her feed into milk she at first uses it to regain condition lost during the winter. The fear of milk-fever is a common objection raised to having cows in good condition at calving time, and although an excess of fat does probably render a cow more liable to milk-fever, the safety-line is much higher than is generally imagined. It is probable that far more cows are lost through weakness than succumb to milk-fever through overcondition ; poverty at calving-time has such a detrimental effect on production that it is worth while taking a few risks.

In arranging a system of feed provision supplementary to grass careful consideration should be paid to the respective requirements of the winter, the early spring, and the late summer and autumn. Adequate feeding in the winter and spring is most important if a long high-producing lactation period is to be obtained from the cows. Cows calving in poor condition may not reach their maximum production till November, and the loss of milk-yield in the early lactation months is not noticed, because of the gradual increase in production as the season advances. A drop in milk-yield in the summer is very noticeable, and summer supplementary feeding often receives more attention than winter and spring feeding. The requirements for supplementary feed for the winter and spring do not vary greatly from year to year, whereas the summer requirements are very variable. The provision of winter and spring supplementary feed should receive first attention.

In feeding dry cows in the winter it should be remembered that normally a cow's fodder consists of green pasture grass with a moisture content of about 70 per cent. Pasture hay contains only some 15 per cent. of water, while roots contain about 90 per cent. If cows in the winter are fed either hay alone or roots alone digestive troubles are bound to occur, and the ration of a cow should be balanced so that it contains both dry and watery foods, the normal ration being about 14 lb. of hay and 50 lb. to 60 lb. of mangolds. Cows when dry are satisfied with bulky foods having a wide nutritive ratio, whereas when in milk they require highly nutritious fodders with a narrow nutritive ratio. Economy of feed is obtained by wintering the cows on coarse fodders such as hay and roots, and saving as much as possible of the winter growth of grass for the spring when the cows calve. When feeding hay and roots the hay should be placed in the field first thing in the morning, and the animals should be allowed to eat part of their hay ration before the roots are thrown out for them. Eating half-frozen roots on an empty stomach is a frequent cause of digestive troubles.

The usual methods of winter-feed provision are—(1) hay alone, (2) hay and ensilage, (3) hay and roots, (4) roots alone. The feeding of hay alone or roots alone is not generally satisfactory, and the chief point for consideration is whether the dairy-farmer should keep his whole farm in grass and rely entirely on hay, grass ensilage, and permanent forage crops such as paspalum and lucerne, for supplementary feeding, or whether it is better economy to grow roots for winter feeding. The question is capable of no general solution, but must be considered in relation to the conditions obtaining on each individual farm. Roots for winter feeding have the advantage of a high yield per acre, and 1 acre of carefully cultivated roots will produce as much winter feed as the grass from 8 or 10 acres of pasture converted into ensilage. When heavy winter feeding is aimed at it is usually impossible to save sufficient hay and grass ensilage for winter and summer feeding without seriously reducing the amount of feed available for cows in the late spring and summer. Probably the best plan is to save grass ensilage for summer feeding and grow sufficient roots for adequate winter feeding.

PASTURE-MANAGEMENT.

Permanent pastures will greatly benefit by a heavy tripod harrowing in the winter. The tripods are very efficient in spreading hard droppings, tearing out moss, and aerating the surface soil. Unspread droppings cause a rank uneven growth which is rejected by stock, and weeds usually occupy the bare spaces left by unspread droppings.

Top-dressing work should be pushed ahead; June is a good month for applying less soluble phosphatic fertilizers such as basic slag.

DRAINAGE.

June is a suitable month in which to finish the cleaning-out of all open drains, and to carry out any tile draining-work that may be necessary. Before starting to tile-drain a field the plan of the proposed drains should be carefully worked out. The main line of tiles should follow the line of natural drainage where water collects. Parallel system of drains is suited to flat-lying land with a gentle slope in one direction. Long parallel laterals give the least amount of double drainage. It is often convenient to have the laterals running parallel to the fence-lines and to the "finishes," in order to give supplementary surface drainage in the same direction. Lateral drains should enter the main drain at an acute angle, and should in no case enter the opposite sides of the main drain at the same point but a few feet of space should always intervene so that the flow of water in the main drains will not be checked by the meeting of two opposing currents. With a poor fall the lateral drains should not be more than 10 chains long; with a good fall—say, 4 in. per 100 ft.—they may be 15 chains. To efficiently drain very stiff clays the parallel drains may require to be 20 ft. apart; on moderately heavy soils 30 ft. to 60 ft. apart. Should springs be discovered in any part of the field it will be found advantageous to remove their water by special drains distinct from the regular system and at a greater depth, so that none of the spring water may be permitted to diffuse itself through the soil.

Tile draining is very costly, and many of the benefits of thorough drainage can be obtained less expensively by mole drainage. A strong,

firm clay or loam, free from stones, offers the greatest facilities for mole drainage. It is essential that the subsoil be of even texture. The surface of the field need not of necessity be perfectly flat or even, for the mole plough may be raised or lowered to some extent to suit the irregularities of the surface, but it must admit of a moderate and fairly uniform fall being given throughout the entire length of each drain.

The mole plough consists essentially of a broad, flat coulter on the bottom of which is a pointed sock, and the mole which is attached to the bottom of the coulter behind the sock. The main drain is cut in the ordinary way on the lower side of the field, and is usually laid in pipes. The main should be 6 in. to 9 in. deeper than the mole drains, so as to facilitate the discharge of water into it. The lines of the drains are usually 15 ft. to 30 ft. apart, and if the field has been ploughed in lands the drains are usually cut up the "finishes." The drains are usually 2 ft. deep. When the main drain has been dug the mole is dropped into the open branch and drawn to the higher side of the field; when it reaches the end of the drain a pin is knocked out of one end of the coulter and the mole comes out of the ground. The plough is then drawn back to the lower side of the field and starts again at the next branch. A mole plough will make about four miles of drains per day. In suitable soils the drains will last from fifteen to twenty years.

—*P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.*

THE ORCHARD.

WINTER PRUNING.

Now that the rush of export work is finished, growers will be directing their attention to other operations in the orchard. As mentioned in last month's notes, it is advisable to have a general clean-up of the packing-shed, grading-machine, &c., before starting on the winter work proper.

Probably the most important winter operation is pruning, and it is as well to get on with this as soon as possible. Many growers leave the pruning until winter is well advanced, and then have to rush the work to get it finished before the trees start into growth in the spring, with the result that many trees are simply cut—the skill, care, and judgment required for pruning not being given. Pruning is an operation that should not be entered upon lightly, so much depending on it for the future welfare of the tree. The previous season's growth and cropping of the tree should be taken into consideration, and pruning done accordingly. Different varieties require different treatment, and it is only by constant observation during the growing season, and acting accordingly, that success can be attained. It must also be remembered that individual trees of the same variety in the orchard call for special attention and treatment.

Although one of the principal objects of pruning is the production of high-class fruit, there are other factors to be considered. It is often noticed that some trees are producing heavily while very little growth is being made. In such cases the pruner must direct his attention to restoring the natural balance between growth and bearing,

otherwise in a very short time both the quality and size of the fruit produced will be seriously affected. Another factor is the building-up of a tree in such a manner that when the time arrives for fruit-production the trees will be sufficiently sturdy to carry their crops equally dispersed throughout the frame without fear of breakages. If this is done the use of props, wires, strings, &c., will not be necessary. The treatment of laterals for the development of fruiting-wood, the elimination of branches not conveniently placed, the amount of fruiting-wood in comparison with the annual growth made, the keeping of the tree reasonably open, the thinning of fruit-spurs on heavily-bearing trees—all these points must be kept constantly in mind when pruning is being done.

It is generally recognized that in most cases light pruning is preferable to very heavy cutting, although there are exceptions when it is necessary to use the secateurs very freely. There are various systems and styles of pruning according to variety and locality, all having the same object in view—that is, the building-up of a sturdy tree capable of producing the maximum amount of fruit—and the pruner must decide, from his knowledge of local conditions, &c., which system he should adopt to get the best results.

Soil-conditions also play an important part in pruning, and no orchardist can expect the best results from his pruning unless his cultural operations are sufficiently good to ensure the trees receiving the necessary food and moisture when most required. Drainage, manuring, and soil-fertility must be well considered and appreciated before the full measure of success can be obtained from pruning.

Stone-fruits.

Stone-fruits are usually pruned before pip-fruits, owing to the fact that they start into growth earlier in the spring. To get the best results the trees must be kept in a healthy and vigorous growing condition. This will encourage the production of lateral growth, on which most of the fruit is borne.

Peaches and nectarines produce the best fruit on the previous season's growth, consequently this class of growth should be encouraged as much as possible. Heavy laterals, not required for fruit, should be cut back close to the buds at the base. From these buds new laterals will form, which will be the fruiting-wood for the following season. Retain the small laterals for fruit-production, after which cut out at the base, making room for further laterals to develop. Keep the trees well open with equally-spaced leaders, cut out all dead wood, and induce the fruiting habit by careful production of lateral growth all through the tree.

Plums according to variety, whether Japanese or English, require slightly different treatment from the peach and nectarine. The Jap varieties are usually strong growers, and come to the fruiting-stage much quicker than English plums. Harder pruning can be done, especially on the leaders, while some of the laterals can be cut back to form spurs, on which good fruit is borne as well as on the previous season's growth. With the English varieties it is necessary to cut fairly hard in the early stages so as to produce a sturdy tree, after which light pruning is all that is necessary. The fruit is borne on spurs

developed from two-year-old wood and over. These spurs usually last for about four years and then die back. A constant supply may be obtained by treatment of the laterals each season.

Cherry-trees, like the English plum, require good cutting for the first season or two after planting. From this on very little pruning is required, only sufficient cutting being done to produce an average extension every season. If left unpruned cherry-trees will gradually become stunted, and the fruit produced will be of very inferior quality. The treatment of laterals and the formation of spurs should receive special attention, as it is on these that the best fruit is grown. Heavy cutting of branches is not recommended, as they often fail to respond, and gumming is the result.

Apricots in suitable districts are usually heavy growers, and require liberal pruning each season. The fruit is borne both on the previous season's growth and on spurs, and in the majority of cases laterals may be cut back to form extra spurs, or eliminated entirely if sufficient fruit-bearing wood is produced direct from the main branches. An exception must be made with the Roxburgh Red, the laterals of which are retained for fruit-production. In many instances the short fruiting-wood of the apricot dies back after two or three seasons. This can be partly remedied by cutting some of these growths to the collar at the base of the laterals every season, allowing the others to bear fruit and to be replaced the following year by new growths coming from the buds round the collar.

—*G. Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

It is an outstanding fact this season that growth is late, abundant, and soft, resulting from the prolonged dry spell of weather followed by a late autumn favourable to growth. Such vegetative conditions render the trees much mo liable to frost injury than is the case with early-grown wood well-matured prior to the low-temperature season. Experience of past seasons has proved that adult trees, though temporarily checked and requiring the removal of much wood which has been killed by frost, are not permanently injured by the temperatures usually experienced, and make a good recovery during the succeeding summer. Practically the only safeguard which can be taken against frost damage to adult trees is to fill up all gaps in the shelter-belt, and deflect rather than encourage by ready passage the frost currents which usually sweep through such gaps. Later, in the event of tip-damage occurring, such damaged wood should not be immediately pruned away but left until danger from frost is over, during which time it will act as a protective covering and take the full force of succeeding low temperatures. With young trees the danger of permanent damage is more real, and trees subjected to low temperatures may be lost or damaged to such an extent as to be unable to recover full vigour. In situations where frost is to be expected some local protection, such as a wigwam of sacking or scrub, should be provided.

At this period trees should be sprayed with bordeaux, 4-4-40. This is advisable for several reasons, but is usually done to protect young and growing fruits from verrucosis and grey scab. Owing to the light set of fruit this season the spray may not be considered

necessary for this, but it is well to keep in mind the other virtues of early winter bordeaux, such as precaution against citrus brown-rot, a general hardening of foliage to help withstand frost, and a prevention of verrucosis on wood and foliage.

Ground work for the month will consist of keeping drains open to avoid stagnant water, and rough preparation of new land on which trees are to be planted later.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CONDITION OF THE BREEDING-STOCK.

CONSIDERABLE judgment is required at this period of the year in regard to the feeding and general management of the different classes of stock, owing to the fact that provision of a similar ration to all birds in the flock would be a mistake. The food for the hens that are to occupy the breeding-pens in the coming season should be of a different character from that supplied to the laying pullets or even the hens which it is not intended to breed from—that is, if the breeding-birds are to be in a proper condition at the time of mating. The great aim should be to maintain the birds in a perfectly healthy state, but at the same time every care should be taken to see that they do not get into an overfat condition, as it is well known that good hatchable eggs and strong chicks cannot be produced from an overfat breeder. It is true that there is little danger of overfeeding the good layer with the right class of food when she is in laying condition, but this does not hold when she commences to moult and ceases to lay. Obviously, if she is provided with an abundance of rich stimulating food when not laying, and while there is no tax on her system for the formation of eggs, the formation of surplus fat has every encouragement. As already indicated, this should be avoided at all costs; the birds should be well fed but not overfed.

The aim should be to maintain the breeders in what may be termed a lean condition. To achieve this it will generally be found a wise policy to provide at all times a ration of hard grains such as wheat, oats, maize, &c., and as a rule the greater the variety of food provided the better will be the fertility of the eggs and the stronger the chicks. The grains should be fed in deep scratching-material, so that the birds are compelled to take a maximum of exercise in finding the grains. Reference is now chiefly made to cases where the birds are kept in confined quarters; where a good range is available, or, better still, a free range, nothing can take its place in providing healthy exercise and ideal conditions for breeding-stock. Usually hens during the moulting-period, and until they are nearing a laying-point, are disinclined to take exercise, and as a result when provided with an abundance of food, such as a mash mixture which is easily obtainable, they are encouraged to sit on the perches and grow fat. Thus in recommending a whole-grain ration fed in deep litter, it is with the object of keeping the birds busy as a means of preventing the storing-up of surplus fat. Particularly where a free range is available there is no

objection to giving the birds a light morning mash, so long as it is of a bulky nature. To give bulk to a ration consisting of pollard, bran, wheatmeal, &c., there is nothing better than well-cured finely chopped lucerne or clover hay. If scalded with boiling water and allowed to stand overnight this makes an ideal food for bulking the morning mash.

From now on, and indeed right through the breeding season, the birds should be frequently handled, and if there is any tendency for them to put on surplus fat the ration should be slightly reduced. They should also be encouraged to exercise as much as possible to prevent fat-accumulation. With birds that are being kept for egg-laying alone there is not the same objection to their getting into a more or less fat condition, for the reason that when nearing a laying-point they can be forced for egg-production, with the result that the amount of surplus fat will soon be reduced to a minimum. In the case of the breeding-hens, however, the matter is entirely different; it would be simply courting disaster to force a bird for eggs during the time it is producing these for the renewal of stock. I would again emphasize that if the breeding-hens are in an overfat condition, due to being provided with the wrong class of food or lack of exercise, not only will there be a high percentage of infertile eggs, but trouble will also be met with in the hatching and rearing of the chicks produced. The dead-in-shell trouble during the various stages of the incubation process is invariably due to a weak germ, and the weak germ traces back to the breeding-pen.

As is the case with all classes of stock on the plant, the breeding-hens cannot be oversupplied with greenstuff, while ample fresh water and grit are details which must not be overlooked.

A mistake often made is to endeavour to patch up for the breeding-pen a bird that has apparently recovered from some disorder It is always a risky matter, and the mistake, of course, is discovered when it is too late. A hen that has been affected with some trouble may recover sufficiently to more than pay for her keep, but such a bird is better kept out of the breeding-pen. The worst mistake that can be made in this connection is to use for the renewal of stock a male bird that has had its health impaired at any time. A weakness probably remains, and it therefore has not the stamina necessary to ensure the production of healthy offspring. I have seen many cases of weak stock which could not be successfully reared as a result of using doctored breeding-birds. To ensure the most satisfactory result there must be no question as to the constitutional vigour possessed by the parents.

FOWLS SLEEPING IN THE NESTS.

It is common for fowls, particularly when going through the moulting process, to acquire the habit of sleeping in the nests and not on the perches. No doubt the chief reason for this is that being incompletely feathered the birds feel the cold, and resort to the nests, which provide a warmer sleeping-place than the perches. It is a habit, however, which should be broken at the earliest possible moment, for the reason that it not only encourages the presence of insect pests, particularly the red mite, but also the eggs cannot be gathered in a clean state. The red mite—probably the worst enemy of domesticated fowls in this country—usually makes its first appearance on the

perches, or, of course, any other place where the birds rest by night. It is a simple matter to deal with the mite when its presence is confined to the perches, by having the ends of the latter arranged in such a way that they or the birds' feathers do not touch the walls of the house, and by giving the perches a frequent application of some kind of thick oil or grease to which is added some disinfectant or kerosene. Not so, however, when the mite gets a good foothold in the nesting-quarters, for from these they may soon spread to hiding-places in the walls, and when once this happens there is no telling when the pest will be stamped out.

Once birds take to sleeping in the nest the only practical way of breaking the habit is to place an obstruction in front so as to prevent them from entering. A board placed in front of the nests, or a piece of wire netting arranged in such a way as to be easily put up or taken down, will serve the purpose. The obstruction should be placed in position before roosting-time, and removed first thing in the morning to allow the birds to lay in the nests. Obviously some work is entailed in keeping the birds out of the nests by night, but in most cases this will prove a mere trifle compared with the labour of washing soiled eggs and cleaning up vermin-infested quarters.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

PREPARATIONS FOR WINTER.

As the off season is approached, and before the weather breaks for winter, it is essential to make the hives as snug as possible. New Zealand has its season which corresponds with the winter months in colder climates, when breeding almost ceases and food is scarce or entirely absent in the fields. Every effort should therefore be made to conserve the natural warmth of the bees. As indicated last month, mats are essential, and each hive should have at least two, and two spare ones, as occasionally dry mats are needed in exchange for damp ones. Good clean corn-sacks make the best mats. Cut the mats so that they exactly cover the frames, and on no account allow them to extend beyond the walls of the hive, or they will become wet and cause dampness, thus endangering the health of the bees.

REMOVAL OF SPARE SUPERS.

All supers not occupied by the bees should be removed preparatory to making the hives as snug as possible. A strong colony with a good queen at this time will need its brood-chamber and at least a super, and these will be fairly crowded with bees, most of them bred since the close of the working season. These are the colonies which one should strive to have at this season of the year, as they will come out strong in the spring and give the best returns when the main honey-flow sets in. As robber bees are likely to become troublesome when removing the supers, the best and safest plan is to use bee-escapes, for it will be found that quite a lot of bees must be got rid of before the supers can be removed. By placing the escapes on the hives in the evening the

supers will be clear of bees in the morning, providing there is no brood in the combs. If escapes are not used all hive-manipulations should be carried out expeditiously and as early in the day as is convenient.

SPARE COMBS.

In the absence of a proper comb-room, or any convenient place to store the combs to keep them clean from the wax-moth and vermin, they, with the supers, may be placed on the hives after confining the bees below with close-fitting mats. As a temporary means of protecting combs this plan serves the purpose. However, it is not a good one for preserving the combs for any length of time during the winter months, as there is a danger of the combs becoming mouldy. This will occur sooner or later in supers from which the bees are entirely shut out.

ANNUAL CONFERENCE.

The annual conference of the National Beekeepers' Association is to be held at Hawera on 29th and 30th June. The organizer of the South Taranaki Winter Show, which is to be held at the same time, is collaborating with the executive of the National to make the beekeepers' stay at Hawera enjoyable. Papers will be given by commercial beekeepers on subjects of interest. A comprehensive display of honey is being arranged at the winter show.

E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

PRUNING BUSH-FRUITS.

Suitable annual pruning of bush-fruits is as important as feeding and spraying, if they are to be kept in health and profit. On raspberry and loganberry brakes the fruiting-canes should have been cut out and burnt as soon as the crop was gathered, so that the young growth could be fed and sprayed to bring it into the best condition for next season's cropping. If this has not been done the old canes should now be cut out at the surface of the ground, removing also small thriftless growth. Train in the strong new growth for next season's crop, removing the short length of unripened wood at the tips.

Red and white currant bushes should be kept open to admit light and air. For that reason crowded growth should not be permitted, and where it occurs the superfluous growth should be removed completely. After this has been done, thin or shorten the small fruiting laterals on the permanent leaders as may be required, and top the leaders only if further extension is desired.

The black-currant brakes demand quite different treatment. These plants crop best with a denser growth and on young wood. For this reason the centre is not opened, but the old wood should be cut well back to a bud about its base and the young wood left without shortening the tops. This treatment, with the generous feeding this plant requires, will produce an abundant annual growth of young fruiting-wood. This valuable crop is best grown on moist well-drained soil in the cooler districts.

The gooseberry crop will be increased and more easily gathered if the bushes are pruned by opening the centres, removing the branches lying on the ground, and thinning out the remaining frame-work if it is crowded, as is so often the case. Finally shorten back old bearing-wood and the weak new growth to base buds. This leaves a good supply of medium-sized new wood, from which the unripened ends should be removed.

SEEDS AND POTATO SETS.

Potato sets are too often allowed to shrivel and sprout by being kept in a dark, dry position. If the quantity is small it is better now to spread them in trays and give them light and air. The short growth made under such circumstances is thrifty and sound, but where larger quantities have to be dealt with they should be given cool, light, humid conditions with no chance of heating. The practice of packing them in wide-jointed fruit-cases and stacking them in the shelter of trees in the open that is sometimes adopted is very suitable so long as they are not liable to be eaten and nibbled by vermin. If these stocks are not to hand they should be obtained without delay, as good sets are scarce. A certain quantity of certificated potato seed may now be obtained ; this is an opportunity the keen grower should not miss.

In the purchase of garden seeds there are three points the commercial grower should carefully study, or he may give his time to a worthless object. The three points are quality, strain, and variety. Under the first heading come the considerations of germination and freedom from disease. It is important to ascertain the germination percentage, so that the drills can be properly adjusted when sowing. The work of thinning the seedlings may then be unnecessary in many instances, and certainly it will be lighter. The evidence regarding the danger of seeds carrying many kinds of fungous and bacterial diseases is now well established, and great care should be taken when harvesting or purchasing seeds to make sure, as far as possible, that they are free from disease. Remedial treatments for seed are now being worked out, and the danger from this source will no doubt be greatly lessened in the near future.

Seeds may be sound and of high percentage germination, but the habits of the plant may be thriftless. In the case of cabbage or lettuce it may easily bolt into seed-growth without heading, or celery may be hollow-stemmed, or tomato-plants may set few fruits or many small ones. While these troubles may be due to cultural methods or unseasonable weather, they are also often due to cheap seeds of poor strain. Bright strong seeds are very easily grown, but to maintain a high strain of seeds in annual and biennial plants demands a great deal of conscientious skill ; but their value, however, will be readily appreciated by the experienced grower.

The guile of the seed catalogue is very fascinating to one who, if he has a little imagination, will be impressed with the descriptions of the various forms of plant perfection that are given. The catalogue-writer omits to state that all his fine promises are made under the condition of "weather and circumstances permitting." Of course, these statements are generally quite accurate as far as they go, but experience has taught that when transported to another country, or even district, varieties of high promise are sometimes disappointing — a literal

instance of circumstances altering cases. For that reason new varieties should be tested experimentally first, or the disappointment and loss may be great. There is another feature, however, about this that should not be missed: many a variety that has received an adverse verdict after trial has later come into considerable popularity; Kondine and Dreadnough tomatoes, for instance. What has happened, and what frequently happens, is that a variety after becoming acclimatized sometimes shows great improvement; or even the reverse may happen. For this reason it is well to be rather conservative in the matter of selecting plant varieties for main cropping. Small trials of new varieties from a good source, however, should be made, for they are sometimes of great value

TOMATOES AND CUCUMBERS UNDER GLASS.

Towards the end of June is the usual time for sowing the seeds of these crops, with a view to planting them in the glass-house towards the end of August. Use sterilized soil in the seed-boxes, and see that both the soil and water are sufficiently warm before use; they should be of the same temperature as the hot-bed on which the seeds are grown. Many of these crops are delayed, even if the plants are not seriously injured, by being chilled occasionally in the seed-beds. This danger is greatest where the temperature is sometimes allowed to run high. A temperature of 55° to 65° F., with dryish atmosphere, will give best results.

—*W. C. Hyde, Horticulturist, Wellington*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 22nd March to 3rd May, 1928, include the following of agricultural interest:

No. 57050: Teat-cup claw; W. R. Cockburn, Otahuhu. No. 57169: Fencing-standard; H. W. Black, Manutuke. No. 58175: Teat-cup claw; T. Shiels, Wanganui. No. 58885: Dressing flax; A. J. Whiteside, Thames. Nos. 59489 and 59490: Teat-cup; International Harvester Co., Chicago, U.S.A. No. 59872: Tension-distributor for sheep-shears cutter; G. I. Stuart, Motueka. No. 56689: Plough-lift; T. M. Emerson, Te Ore Ore, Masterton. No. 58185: Harrow; A. Dale, Albury. No. 58252: Pasteurization of cream; T. Topliss, Greymouth. No. 58363: Centrifugal separation; Zeala Products, Ltd., Hawera. No. 58736: Cream-separator driving-means; W. Webb, Whangarei. No. 59010: Harrow; A. C. Sutherland, Whakatane. No. 60083: Distributing fertilizers; J. W. F. Lange and T. H. Varcoe, Mount Gambier, S. Australia. No. 60136: Pulsator for milking-machine; Aktiebolaget Separator, Stockholm, Sweden. No. 57780: Manufacture of condensed milk; L. R. Scammell, Adelaide, S. Australia. No. 57884: Teat-cup; W. Capil, Invercargill. No. 58242: Milking-machine; Warren Engineering Co., Ltd., Auckland. No. 58313: Milking-machine pulsator; A. B. Robertson, Hamilton. No. 5830: Teat-cup; Dr. Hutchinson, Kaponga. No. 59155: Mole drain-plough; A. A. Hawker, Hamilton. No. 5982: Evaporated milk; Borden Company, New York, U.S.A. No. 60130: Sheep-shears; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 60159: Animal-trap; H. W. Tildesley, Willenhall, England.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

WEATHER RECORDS: APRIL, 1928.

Dominion Meteorological Office.

GENERAL SUMMARY (ABRIDGED).

APRIL, on the whole, was a mild and humid month, with an absence of extreme temperatures. Although gales were recorded on several occasions, and that of the 30th was very severe, there were few drying winds. Rainfall was below normal over most of Taranaki and parts of the Manawatu, Hawke's Bay, and North Canterbury districts, but elsewhere there was an excess, which in most cases was considerable. Large areas in Nelson, Marlborough, Westland, South Canterbury, and North and Central Otago received more than double the average fall.

The central provinces experienced heavy falls in the wet spell which occurred during the Easter holidays. This was a particularly beneficial rain, since it was accompanied by very mild temperatures. It extended over several days, and in the early stages was light but steady; the ground, therefore, became thoroughly soaked, but the maximum of good and minimum of damage was done. Complete relief was given from the very dry conditions which had prevailed for the greater part of the interval since the end of December in Nelson and to a less extent in other districts. In other parts of the Dominion the heaviest rains were generally recorded in connection with the stormy period which commenced on the 25th and culminated on the 30th.

Sunshine was below the average, and cloudiness and humidity above. Mean temperatures were two or three degrees above normal at most places. Damaging frosts occurred in some parts of the South Island on the 5th and the 22nd. Gales were experienced over wide areas on the 4th, 12th, 14th, 16th, 21st, and 30th. None of these, however, was a westerly gale, and consequently, as mentioned above, none of them had any great desiccating effect. Much misty weather, with fog in many places, was experienced in connection with the several cyclones which controlled our weather at intervals during the month.

RAINFALL FOR APRIL, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average April Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kataia	5·58	14	1·60	3·55
2	Russell	6·15	14	2·20	3·59
3	Whangarei	7·83	13	2·73	4·45
4	Auckland	4·90	21	1·69	3·46
5	Hamilton	5·94	15	3·06	3·86
6	Kawhia	4·98	13	2·84	4·64
7	New Plymouth	4·19	4	1·17	4·51
8	Riversdale, Inglewood ..	7·20	15	1·51	8·39
9	Whangamomona	5·95	9	1·24	6·62
10	Eltham	3·09	14	1·27	5·10
11	Tairua	7·36	9	4·80	6·33
12	Tauranga	5·14	8	2·89	5·08
13	Maraehako Station, Opotiki	4·02	10	2·48	4·57
14	Gisborne	2·28	10	1·61	4·20
15	Taupo	4·57	9	2·19	3·77
16	Napier	0·91	7	0·34	2·92
17	Maraekako Station, Hastings	2·67	9	2·05	3·14
18	Taihape	2·10	16	0·71	3·15
19	Masterton	5·39	12	1·68	3·04
20	Patea	2·17	11	0·43	3·59
21	Wanganui	2·64	10	0·85	3·37
22	Foxton	3·52	5	1·10	2·47
23	Wellington (Karori Reservoir)	6·03	12	1·70	3·80

RAINFALL FOR APRIL, 1928—*continued.*

No.	Station.	Total Fall	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
	South Island.				
		Inches.		Inches.	Inches.
24	Westport	14·08	28	5·80	6·50
25	Greymouth	14·24	26	1·75	8·37
26	Hokitika	16·76	23	2·32	9·38
27	Ross	20·78	15	3·26	12·55
28	Arthur's Pass	28·72	18	6·96	16·16
29	Okuru, Westland	42·62	16	6·50	13·67
30	Collingwood	18·20	17	4·38	8·07
31	Nelson	7·34	13	2·15	2·93
32	Spring Creek, Blenheim	3·68	9	1·65	1·72
33	Tophouse	9·42	17	2·35	4·22
34	Hanmer Springs	1·76	15	0·48	2·99
35	Highfield, Waiau	0·90	6	0·30	2·66
36	Gore Bay	2·12	10	0·53	1·77
37	Christchurch	1·24	12	0·71	1·97
38	Timaru	3·74	14	0·76	1·51
39	Lambrook Station, Fairlie	3·41	13	0·58	1·95
40	Benmore Station, Clearburn	7·28	16	1·70	2·55
41	Oamaru	3·88	12	0·75	1·78
42	Queenstown	6·05	14	1·17	3·00
43	Clyde	2·80	12	0·62	1·34
44	Dunedin	4·35	16	0·80	2·82
45	Wendon	4·58	13	1·32	3·16
46	Gore	5·86	16	1·20	3·15
47	Invercargill	4·99	18	1·00	4·36
48	Puysegur Point	11·81	20	4·02	7·98
49	Half moon Bay, Stewart Is.	5·49	16	1·26	5·29

WHEAT AND OATS THRESHINGS.

TABULATED below are returns of actual threshings received by the Census and Statistics Office up to 19th April from threshing-mill owners, and covering the months of January, February, and March, 1928:—

Land District.	Wheat.		Oats.	
	Quantity threshed.	Average Yield per Acre.	Quantity threshed.	Average Yield per Acre
	Bushels.	Bushels.	Bushels.	Bushels.
North Auckland	..	..	..	..
Auckland	311	18·29	..	..
Gisborne	1,947	26·31	304	30·40
Hawke's Bay	10,634	34·75	10,567	34·65
Taranaki	..	..	..	..
Wellington	58,392	35·78	29,477	42·23
Nelson	21,085	28·04	7,756	30·42
Marlborough	62,507	29·35	28,608	32·36
Canterbury	3,465,209	40·04	1,209,825	44·56
Otago	497,700	36·01	299,519	47·99
Southland	53,166	34·93	329,844	47·32
Dominion totals and averages	4,170,951	39·05	1,915,900	45·06

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LOSS OF LAMBS.

C. and Co., Spring Creek :—

We have lost quite a number of lambs this year on our second feed-off of rape and on stubble. The symptoms are—dopy, excessive scouring, at times a desire for water, and after a few days death. There is no cough ; we have opened several lambs and can find no trace of lung or stomach worms. We have examined the paddocks thoroughly where the deaths have occurred, and can find nothing harmful except a prolific growth of deadly nightshade, which came up after the rain in February. Would this, if eaten, cause the deaths, and are the symptoms described those that are brought on by eating the nightshade ? Also, is the plant more poisonous at one particular stage of its growth ? Any information you can give on the subject will be appreciated.

The Live-stock Division :—

The symptoms described by you do not coincide with poisoning by the plant mentioned ; moreover, it is probable that the plant is not deadly nightshade but the black or common nightshade (*Solanum nigrum*). There is no evidence recorded of poisoning by the latter. It is highly probable from the history and the symptoms described that the cause of the mortality was internal parasites, especially the stomach-worm. It is at times difficult to demonstrate these parasites on post-mortem if the animal has been dead for some time before the post-mortem is held, hence their presence may have been overlooked. It may even be necessary on occasions to take a scraping from the mucous membrane of the stomach and have it examined under a microscope. When examining for parasites it is advisable to kill an affected animal and examine the contents of the stomach or bowels when fresh.

BOULDER DRAINS.

E. A. M. Lys, Mangatoro :—

I intend constructing some drains of boulders, and will be grateful if you will inform me on the following points : (1) Minimum size the boulders should be ; (2) depth of boulders required ; (3) how boulders should be arranged in trench ; (4) whether it would be any advantage to dig a V-shaped trench to receive boulders rather than a U-shaped one ; (5) whether it is necessary to put any covering, such as manuka, over boulders before covering with earth ; (6) fall required.

The Fields Division :—

Your inquiry can be answered only in a general way, for so much depends upon circumstances. For instance, if the boulders have to be carted any considerable distance their bulk and weight make the cartage expensive. In the first place, a much larger excavation is needed with boulders than with pipes, and there is no advantage in digging a V-shaped trench. Stones which would pass through a 2½ in. to 3 in. ring have been used with success. Larger stones, especially if flattish, can be used more effectively if set up in triangular or square form so as to leave a passage for the water. Above these larger stones can well be packed smaller ones decreasing in size as they approach the top of the drain. Within reasonable limits, the greater the depth of boulders the better the drain, but this will also be determined by the depth to which one can make the excavation and the quantity of boulders within easy distance of the drain. The use of manuka as a covering is to be recommended, provided it can be obtained without unreasonable cost or labour. If manuka cannot be used, the top layer of turf should be set aside when making the excavation, and should be carefully placed over the boulders in the drain before the filling in of the earth is commenced. Care should be taken to see that the boulders, and any covering such as manuka

placed above them, are deep enough to be undisturbed by any cultivation operations. A fall of 1 in 250 at least is desirable, but if circumstances compel somewhat less will do. Avoid changing from a given fall to a lesser one, otherwise the drains are likely to become blocked quickly. It is well to remember that generally stone drains do not allow the water to flow freely, favour the deposition of salt, and are liable to get out of place.

AFRICAN BOXTHORN FOR CENTRAL HAWKE'S BAY.

"INQUIRER," Otane :—

Please inform me whether African boxthorn is quick-growing, and if it needs to be protected from stock for long. What is the best method and time for planting, and would it do well in the Otane district?

The Horticulture Division :—

On well-drained soil in the Otane district the African boxthorn would undoubtedly do well. Plant it any time during the winter when the land is reasonably dry and friable, placing the plants at their usual depth in the ground and firming them well. For long lengths a suitable method would be to chip and clean a strip of land about 1 ft. wide on each side of a wire fence. This should be well done in good weather. Then plant the shrubs a foot or two apart, close up to the wires and on the same side of them as the posts. They should not then require further protection. Give the hedge close attention for a year or two, and the boxthorn should be as quick-growing as most hedge-plants.

UNDEVELOPED UDDER-QUARTERS IN HEIFER.

"INQUIRER," Havelock North :—

I have a Jersey heifer coming in at two years old which appears to be developing only two quarters. I also had one last year which only developed one quarter. They were no relation to each other. Could you suggest any cause; also, could anything be done to avoid the trouble?

The Live-stock Division :—

As only two quarters of the udder appear to be developing, daily massage for the two weak ones is suggested. Unless there is an inherited weakness in the strain, or total absence of mammary tissue in the two weak quarters, the latter will develop normally as the heifer approaches parturition. The defect you mention is not common, and may result from inbreeding where sufficient attention is not paid to that most important organ the mammary gland. In regard to prevention, it is advisable to very carefully examine the undeveloped mammary glands of all young heifers before service. If all four quarters are then apparently normal the animals may be put to service.

FORTHCOMING WINTER SHOWS.

Waikato Winter Show Association : Hamilton, 29th May to 5th June.
Otago A. and P. Society : Dunedin, 2nd to 7th June.
Poverty Bay Winter Show Association : Gisborne, 6th to 9th June.
Taranaki Metropolitan Agriculture Society : New Plymouth, 12th to 15th June.
Manawatu A. and P. Association : Palmerston North, 19th to 23rd June.
South Taranaki Winter Show Company : Hawera, 27th June to 4th July.
Auckland Winter Show Association : Auckland, 11th to 21st July.
Canterbury A. and P. Association : Christchurch, 4th to 18th August.

Eggs and Egg-pulp in Cold Storage.—At 31st March last the following quantities were in storage in the Dominion : Eggs in shell, 59,181 doz. ; egg-pulp, 835,097 lb. ; frozen whites, 1,360 lb. ; egg-yolk, 500 lb.

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TOP-DRESSING OF HILL-COUNTRY PASTURES.

TRIALS ON KING-COUNTRY FARMS.*

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THE top-dressing of permanent pasture with fertilizers, a practice that now bulks largely in the farming of many districts, has of late received increasing attention from hill-country farmers also. To men who have no means of cultivating worn-out pastures the prospect of being able to achieve renovation by means of manuring is particularly attractive, and some thousands of tons of fertilizer annually are now applied by hand on the hill bush-lands of the King-country.

As was anticipated, there are many instances in which the fertilizer has wrought such a transformation that the outlay has been recovered with comparative ease. But, as was also anticipated, there are a number of cases in which the improvement has not yet been sufficient to enable the operation to be characterized as successful. Where the cost per acre is comparatively high and the return per acre, even under the best of management, must be comparatively low, it is highly important that the farmer should confine himself to practice that experience has shown to be capable of giving a fair return for outlay.

It was with the object of investigating the various factors involved in the economic side of hill-country top-dressing and of endeavouring to define as accurately as possible its economic limit that a series of co-operative trials was started, tentatively in 1924 and 1925, but on a larger scale in 1926. These trials are still in progress, but already various conclusions may be drawn affording useful information to hill-country settlers.

Carrying-capacity Trials.

Seeing that the ewe is easily the most profitable animal on the farm (leaving dairying out of account), and that the winter months from June to September represent the most critical season on all pastoral holdings, an effort has been made to ascertain the increase in ewe-wintering capacity on the various types of land. This has meant the manuring of ring-fenced paddocks and recording of stock carried before and after each dressing. The results to date are given in brief, as a full description of

* Some preliminary notes on this subject, entitled "Top-dressing of King-country Hill Lands," were published in the *Journal* for November, 1926.

the work at each of the thirteen centres operated in would be impossible within the limits of this article.

K. A. W. Mackenzie, Oparau, Kawhia County.—A nineteen-year-old bushfelling on light semi-volcanic loam, going strongly into danthonia. Top-dressed with 2 cwt. basic super per acre in September, 1926 (17s. 11d.),* and again in June, 1927 (16s.). Wintering-capacity increased from less than one ewe to a ewe and half a hogget. Stock much improved in condition, lambing percentage higher, and mortality lower; similar result with cattle.

Harty Bros., Honikiwi, Otorohanga County.—A twenty-three-year-old bushfelling on volcanic clay; rather steep; mainly danthonia. Paddock A: Top-dressed with 2 cwt. 44/46 super in August, 1925, and again in March, 1926; improvement very slow at first, but now represents an increase of 50 per cent. in wintering-capacity, with decided improvement in stock. Paddock B: 2 cwt. 44/46 super in June, 1926 (21s. 6d.), and again in April, 1927 (19s. 6d.); increased carrying-capacity, 40 per cent., and much improved condition in stock, especially in the lambs.

Tynan Bros., Te Anga, Kawhia County.—Ploughable land on poor clay formation, originally in manuka; brown-top dominant in pasture, with some paspalum. Paddock A: Top-dressed with 2½ cwt. basic super in August, 1926, and again in June, 1927; carrying-capacity in sheep and cattle more than doubled, and improved condition of stock very noticeable; manuring has already proved profitable. Paddock B: 1 cwt. each of basic super and 30-per-cent. potash at same dates as Paddock A. Though costing the same sum per acre, Paddock B has not shown nearly as much improvement in returns, and the profit is still doubtful.

A. Moore, Putake, Waitomo County.—Old bushfelling on clay and rubble at 1,800 ft. altitude. Pasture of English grasses with some danthonia. Top-dressed with 2 cwt. per acre of basic super during summer of 1926–27 (20s.). Increased capacity three eighths of a ewe per acre, with great improvement in condition of stock. Manuring not yet recouped, but second dressing may prove profitable.

P. Naish, Mairoa, Waitomo County.—A seventeen-year-old bushfelling on crystalline limestone formation, mainly in danthonia. Top-dressed with 2 cwt. basic super in August, 1926. Increase during following summer, 120 wethers to 300. Improvement has since been maintained, but mainly in the shape of cattle. Sheep did not escape the usual attack of debility, probably due to parasitic infection, but the increase in wool alone nearly covers the cost of the manuring (15s. 6d. per acre).

Dimond Bros., Waitomo Caves.—A potash trial was included, the average dressing over the whole area being 180 lb. of basic super and 67 lb. of 30-per-cent. potash; this was in August, 1926, and June, 1927. Including a dressing of slag previously given, 25 acres have cost £60 for manure, and the increased value of stock grazed to November, 1927, was estimated to be £45. There is no doubt that the remaining £15

* Figures in parentheses refer to cost per acre; in all cases this amount includes freight, cartage, and all handling-costs.

will be made up this season, leaving a profit in the shape of a greatly improved paddock. Ewes carried in 1925, eighteen ; 1926, twenty-five ; 1927, forty. Fat lambs now obtained in place of stores.

A. C. Ronaldson, Awakino Road, Te Kuiti, Waitomo County.—Broken rhyolite country with thin loamy soil, originally in light bush. Before top-dressing, pasture had run out into Yorkshire fog and ragwort. Manuring has been accompanied by systematic crushing with cattle, 2 cwt. basic super in July, 1926 (16s.), and again in June, 1927 (14s.). Now winters eighty-five ewes and ten hoggets well, in place of forty done hard. This is an instance in which it has been possible to save the English grasses, which are now thoroughly revitalized. Top-dressing has shown a distinct profit.

N. J. B. Dougherty, Toi Toi, Ohura County.—Poor ridge of light shaly papa, felled out of light bush in 1913. English grasses nearly out and danthonia increasing rapidly. Top-dressed with 2 cwt. basic super in October, 1926, and again in May, 1927. Very little visible improvement, but one hundred ewes were wintered in 1927 as against fifty in 1926.

A. L. Ross, Matiere, Ohura County.—Good papa formation, but rather steep and shady, with a good deal of bracken-fern. Top-dressed with 2 cwt. basic super in July, 1926, and again in May, 1927. Wintering-capacity has been raised from one and a quarter to two ewes ; 40 acres also wintered eleven dairy cows in good order. Manuring has probably paid.

W. S. Currie, Tatu, Ohura County.—Twenty-year-old bushfelling on papa and sandstone, badly reverted to bracken in places. Top-dressed with 3 cwt. super and slag in August, 1925, again in June, 1926 (half paddock only), and again in May, 1927. Total cost per acre, £3. Paddock has not been properly stocked, and manure sown in fern has been useless ; but the clean grass has improved remarkably, and the whole paddock has increased in capacity from one ewe to two ewes per acre.

J. F. Waldegrave, Kaitieke.—Old bushfelling on rubble and papa ; danthonia dominant in pasture ; 15 acres flat (pumice), 15 acres sunny faces, and 40 acres shady. The two latter areas were given 2 cwt. basic super in September, 1926, and the shady portion a further 2 cwt. in June, 1927. The manure so far has not drawn the stock back on to the shady country. The whole paddock has cost £1 an acre for manure, and the increase is estimated at half a ewe per acre ; it also does lambs far better than previously.

T. H. Tylee, Upper Retaruke, Kaitieke County.—Twenty-year-old bushfelling on steep, inferior papa formation. Top-dressed with 2 cwt. basic super in August, 1926 (17s. 10d.), and again in June, 1927 (16s.). So far there has been no significant improvement in carrying-capacity, but the danthonia has been greatly strengthened and the piripiri (hutiwai) nearly eliminated. The area should do well this winter.

Treacey and Son, Upper Retaruke, Kaitieke County.—Better-quality land and rather easier. Still holding a good proportion of English grasses, though danthonia has increased remarkably. Top-dressed [illegible] 2 cwt. basic super in August, 1926, and again in June, 1927. W[illegible] capacity has increased from seventy to ninety-seven ewes [illegible]

and wethers now fatten well, and there is reasonable prospect of the outlay proving profitable.

Comparative Manurial Trials.

Although basic super was selected as the ideal fertilizer for hill-country use, and though there has been no reason to alter this decision as far as average conditions go, a few small comparative plots were also laid down, with the following results :—

K. A. W. Mackenzie, Oparau.—A dressing of 4 cwt. basic super per acre has not appeared to be any quicker in action than 2 cwt., though it shows some superiority now. Eighteen shillings' worth per acre of 30-per-cent. potash gave very little response, but 18s. worth of mixed potash and basic super was nearly as good as 18s. worth of straight basic super.

A. Moore, Waitomo Caves.—It was found that 4 cwt. basic super per acre was better than 2 cwt., but not 100 per cent. better so far; 6 cwt. not much better than 4 cwt. A dressing of 2 cwt. 30-per-cent. potash per acre showed good appearance at first, but has not the bottom of the supered area; potash in addition to the super is not markedly superior to super only.

Tynan Bros., Te Anga.—Straight basic super has given decidedly better results than the same cash value of basic super and 30-per-cent. potash. Small plots of various potash manures on adjoining land have given a negative result.

P. Naish, Mairoa.—A dressing of 4 cwt. per acre of basic super so far not much in advance of 2 cwt.

Dimond Bros., Waitomo Caves.—Plots receiving potash in addition to the basic super at first appeared stronger in clover, but this has not been maintained, and it is doubtful whether the potash has paid.

P. C. Rose, Kiritehere.—Plots on good-quality clay formation, burnt and resown in 1924, have given the following results: 2½ cwt. per acre basic slag—rather the best throughout; 2½ cwt. basic super—nearly as good as slag; 2 cwt. 44/66 super plus 3 cwt. ground limestone—quite good; 1½ cwt. 44/46 super plus 1½ cwt. Nauru phosphate—fairly good; 1 cwt. basic super plus 1 cwt. 30-per-cent. potash—poor response, and badly grazed.

B. Budden, Honikiwi.—Response to all manures has been slow, probably owing to sodbound nature of turf; but slag has proved rather better than 44/46 super, and both better than Nauru.

Departmental Paddock, Te Kuiti.—Rather sodbound turf of paspalum, with some Chewings fescue and sweet vernal, on fair-quality semi-volcanic clay. Sown down in 1910, but unmanured till 1926. All plots have done fairly well, but 3 cwt. per acre of 44/46 super and 3 cwt. basic super have been slightly the best; 2 cwt. 44/46 super plus 1 cwt. 30-per-cent. potash comes next; then 2 cwt. 44/46 super plus 3 cwt. ground limestone with 3 cwt. basic slag about equal. Ground limestone alone, at 7 cwt. per acre, has given very little response.

N. J. B. Dougherty, Toi Toi.—Potash alone, and potash plus basic super are indistinguishable from the rest of the paddock, which in this case has shown very little visible response.

W. S. Currie, Ohura.—Two dressings of 3 cwt. each have been much superior to one only, but three dressings have so far not been much better

than two. Slag appears to be slightly better than either super or super and slag mixed, but there is no marked difference.

G. C. Hammond, Owhango, Kaitieke County.—Old and badly-grassed bushfelling on undulating country, the soil being a thin loam over float pumice of great depth. All plots have revealed great improvement, though the latter was slow at first. A dressing of 3 cwt. basic super has done well, and rather better than 3 cwt. 44/46 super; 2 cwt. 44/46 super plus 3 cwt. ground limestone ranks next, and 3 cwt. basic slag last. This seems to confirm the general experience of pumice-land farmers in this district that super or basic super is the most profitable manure.

Conclusions.

In submitting the following conclusions it is desired that they should in no way be regarded as final. Work of this nature must necessarily occupy some years, and with conditions in a district such as the King-country, varying very widely as regards soil, climate, pasture-composition, farm-management, and access, one can hardly do more in the scope of a single article than formulate general recommendations.

(1) *Cost of Top-dressing per Acre.*—Where straight phosphatic fertilizers are used, and the area is comparatively large and reasonably accessible, 2½ cwt. to 3 cwt. per acre can be sown for an inclusive cost of £1. Bad access, horse-packing, mixed fertilizers, and other local circumstances may increase this amount somewhat.

(2) *Influence of Soil.*—The loamy soils of volcanic origin that characterize the northern end of the King-country will, broadly speaking, respond well to phosphates, as also will the pumiceous soils to the south, and any papa or good-quality clay. The rubble and clay formation is rather slower to respond, and sandstone is the least promising of any. Any soil that has once been stirred by the plough responds quicker and better than surface-sown land.

(3) *Influence of Pasture-composition.*—An outstanding feature of these trials is the way in which danthonia thrives under top-dressing, and appears to give increased returns comparable with those obtained with the higher-grade grasses. It must be understood that in the vast majority of cases the danthonia is in no sense sodbound, but consists of comparatively young and vigorous plants coming in to take the place of the deteriorated English grasses. In some cases there has been an increase in cocksfoot and other English grasses, but generally the increased returns have been obtained from the danthonia. One of the most hopeful features is that it seems possible by means of top-dressing to create a healthy and productive danthonia-dominant turf which will require a minimum of crushing, fencing, and manuring. Brown-top also seems to respond well to manuring; in fact, a good sole of "hard" grasses is a far more promising subject for manuring than a mixture of weak English grasses, fog, and weeds.

(4) *Effect on Fern.*—Generally speaking, manure is wasted when sown in fern that is at all thick, though a half-and-half mixture of bracken and grass can often be top-dressed quite successfully. No amount of manure will make stock do work that fire should accomplish. Top-dressing helps materially to control piripiri, and is a potent agent in the replacement of the smaller weeds by white clover and danthonia.

(5) *Choice of Fertilizer.*—Phosphates of more or less immediate availability still appear to be the main factor, and constitute the most profitable form of manuring. Heavy clay and papa soils respond best to slag, but basic super is a sound general-purpose fertilizer that can be recommended in all cases. There is no objection to high-grade super, unless it is that on the lighter soils basic super seems slightly preferable, and on the heavier soils basic slag. Potash in general has not given decisive results. As regards nitrogenous manures, it is doubtful whether any hill country could bear the high cost.

Lime has not figured at all largely in the trials, as it was felt that in the light of general experience it was unlikely to give a return in any way commensurate with the high cost of handling, at any rate on country where the carrying-capacity can never be very great.

(6) *Amount of Fertilizer per Acre.*—At present there is no evidence that heavier dressings than 3 cwt. per acre, given two years in succession, would be profitable. Observation rather supports the theory that old surface-sown country cannot at once make use of any large quantity of fertilizer, and that it is best to spread the amount over two or three dressings. Possibly 2 cwt. is too low, the optimum quantity being about 3 cwt. At any rate, one thing is fairly certain—that the second dressing usually brings the most effective result, and that it pays better to manure a given area thoroughly than to dress a fresh area each year.

(7) *Profit or Loss.*—On this point it is impossible to be explicit. Generally speaking, land of comparatively good quality, with a more or less closed sole of grass, that is carrying upwards of a ewe to the acre, will pay well enough, though possibly not for a year or two. Below one sheep to the acre there is a strong probability of a loss on the operation, unless the farmer is satisfied that a good proportion of the sown grasses still survive.

Farmers on the better class of land should make top-dressing a regular feature, starting with their best paddocks first and working back as funds permit. Those on the poorer land must aim principally at top-dressing one or two of their best paddocks into good conditioning areas, farming the rest of the holding on cheap lines with the " hard " grasses.

The writer desires to place on record an appreciation of the hearty co-operation extended by the numerous settlers on whose holdings these trials are being conducted. Thanks are also due to Auckland merchants who presented the fertilizers used on two of the farms, and to other members of the Fields Division who have from time to time assisted with the work.

Protection of Fruit-trees against Hares.—The hare is held to be a clean-feeding animal; consequently any mixture of a dirty or noxious nature is likely to serve for painting the trunks of young trees against its depredations. The most popular of such mixtures, on account of its simplicity, is one made of milk of lime and cow-dung. This should be made to the consistency of paint and applied with a brush.

DISEASES OF DAIRY COWS.

EXTENSION OF DEPARTMENT'S INVESTIGATIONAL WORK.

EXTENDED activities of the Department of Agriculture in connection with diseases of dairy cows have been announced by the Hon. O. J. Hawken, in the following statement :—

"During the last three years the veterinary staff of the Department of Agriculture has been engaged in special investigation work into certain diseases of dairy cows which are causing serious loss to dairy-farmers through decreased returns from their herds. These troubles—contagious abortion, failure to hold to the bull, mammitis, and vaginitis—are all associated with the reproductive and milk-yielding organs; and while more or less intensive methods of dairy-farming naturally predispose cows to troubles of this kind, it has been realized that every effort must be made to assist farmers to overcome them to the fullest extent possible. The work already done by the investigators here has brought out some valuable information bearing directly upon the problems which have been faced; but effective and reliable methods of preventive and curative treatment, especially methods capable of application by the dairy-farmers without too much expenditure of time, money, and labour, have yet to be discovered.

"During his recent trip abroad, Dr. Reakes, Director-General of the Department, devoted a great deal of his time to inquiries into what was known and what research work was being done in regard to this group of diseases. He found them to be more or less troublesome in all the countries he visited, and made a special point of discussing the subject with the most eminent authorities in Great Britain, the Continent of Europe, and South Africa. A great deal of information bearing on the question was obtained, but it is evident that the knowledge necessary to effectively cope with these troubles is not yet available.

"On Dr. Reakes's recommendation it has therefore been decided to further extend our investigation work in the Dominion, and to set aside two skilled veterinary officers—Mr. C. V. Dayus (now stationed at Hamilton) and Mr. W. M. Webster (now at Masterton) —to devote the whole of their time to special field investigations in connection with this group of diseases, in direct conjunction with Mr. C. S. M. Hopkirk, Officer in Charge, and Mr. D. A. Gill, Assistant Officer in Charge, of the Wallaceville Veterinary Laboratory. While these officers will specialize in the investigation, it will be supplemented by the general assistance of all the field veterinary and stock inspection staff of the Department. All the four officers mentioned have for the last three years been concentrating as much as possible upon the work in question, and thus already have a special knowledge of it; hence it is hoped that the more systematic and wider research now being initiated may bring about more knowledge of these difficult troubles, and enable better methods of preventive and curative treatment to be found. The information obtained by Dr. Reakes regarding methods being used in investigation work in

other countries, especially in Denmark and South Africa, will be utilized to the fullest extent, and every advantage will be taken of the personal relations he established with scientists overseas who are working at the same problems for the interchange of views upon the progress of the work."

WHEAT VARIETY TRIALS IN CANTERBURY.

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DURING the years 1913 to 1917 inclusive a variety trial of the then commonly grown wheats was conducted at Lincoln College. The methods employed lacked the refinements we now consider necessary in field experiments, but the results probably reached a considerable degree of accuracy. Table 1 shows these results as far as they concern the varieties still grown.

Table 1.—Variety Trial, 1913–17.

Variety.	Number of Trials.	Average of Five Years' Yields per Acre.	Increase or Decrease compared with Hunters.
		Bushels.	Bushels.
Hunter's	19	44·3	..
Solid-straw Tuscan	19	42·6	-1·7
Velvet	15	39·9	-4·4
White-straw Tuscan	30	36·6	-7·7

During some succeeding years the Department of Agriculture carried on at Ashburton trials of many new wheats in competition with the established varieties, and most of the introductions were gradually eliminated. By 1924 they were sufficiently reduced in number for the undertaking of more elaborate trials, and these were repeated in the three succeeding years. In 1927–28 a duplicate set of plots was laid down at Lincoln as a co-operative effort on the part of the College and the Department, and a survey of all the results is presented in Table 3.

In every case College Hunter's has been used as the standard; the paired drill-strip design has been followed; and the plots have been seven coulters wide, and of a length varying from 1½ to 3 chains. The replications have varied in number from twelve to twenty-eight, and "Student's" method has been used in computing the degree of significance of the results.

The same number of seeds to the acre have been sown in each variety. That every kind of wheat yields its optimum with the same spacing between plants is far from certain, but any definite and recordable plan of seeding is better than none at all.

The following table, which compares the estimated and actual number of seeds of the varieties sown in 1927–28, gives a measure of the accuracy of the drill used:—

Table 2.—Calculated Weights to give Equal Numbers of Seeds and actual Weights sown.

Variety.	Weight per Acre for equal Number of Seeds.	Actual Weight sown.
	lb.	lb.
College Hunter's	90·0	88·8
Major	107·4	106·1
Marquis	93·0	94·5
White-straw Tuscan	111·4	116·0
Red Fife	79·0	90·3
Velvet x Solid-straw Tuscan	87·0	101·0
Solid-straw Tuscan	106·0	105·0

The growth has in all cases been satisfactory for comparison purposes, differences due to soil and weed variations being fully compensated by the number and arrangement of the plots. The lower limit of significance in the difference of yield is about 1·5 bushels per acre. All the plots in any one year have been cut at the same stage of ripeness.

In the year 1927–28, when the crop at Ashburton was very heavy, it was found that White-straw Tuscan, Marquis, and Solid-straw Tuscan lodged in that order, but the degree of lodging was not such as to interfere with the cutting. Major and Hunter's stood up well. At Lincoln there was no lodging, but Marquis, Red Fife, and White-straw Tuscan were much more injured than the other varieties by the competition of a twitch that occurred in one part of the field used for the trial.

The average increases over the adjacent plot of Hunter's are shown in the following table. Differences that are not significant, but are due to chance variations only, are printed in italics, but all the differences are used to give the average result shown in the last column.

Table 3.—Average Yields, compared with Hunter's, of Wheats at Ashburton and Lincoln.

Figures in italics show non-significant differences. Each figure is the average of from twelve to twenty-eight different plots.

Variety.	Increase on Nearest Plots of Hunter's in Bushel per Acre.					
	Ashburton.				Lincoln, 1928.	Average.
	1925.	1926.	1927.	1928.		
Solid-straw Tuscan ..	..	*+1·1*	+7·1	+11·4	+7·4	+6·3
Velvet x Solid-straw Tuscan*	..	..	+3·3	†	+6·4	*+4·8*‡
Major	+5·5	−4·9	+8·6	+10·7	−3·4	*+3·3*
Goldberry	..	+0·5	+2·4	..	−4·0	*−0·4*
White-straw Tuscan ..	+9·0	−2·3	+3·6	−4·8	−12·6	*−1·4*
Velvet	..	*−0·6*	*+1·0*	..	−4·6	*−1·4*
Essex Conqueror ..	−5·0	*−0·1*	*−0·8*	..	−2·9	*−2·1*
Marquis	+2·9	−3·2	+2·8	−3·9	−12·9	*−2·9*
Red Fife	+5·7	−1·7	*+0·4*	−7·0	−14·0	*−3·3*
Yeoman II	..	..	−5·1	..	−11·8	*−7·9*
Hunter's average ..	35·3	14·1	37·8	69·0	64·0	..

* This is probably the Otago variety known as "Velvet Ear." † Ball smut so bad that plots were not threshed. ‡ Significance in last column calculated from Table XXV of "Tables for Statisticians," &c., by Karl Peason, 2nd Edition, on the "Probability of Small Samples," &c. Essex and Yeoman approach significance.

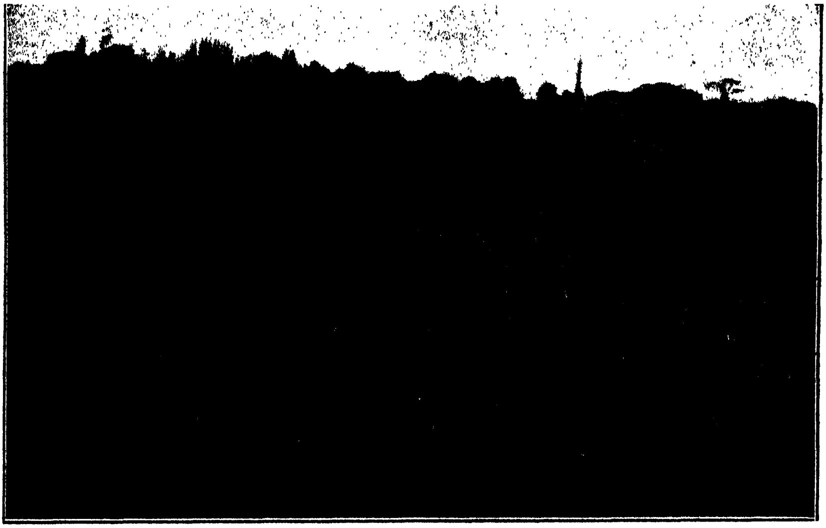

FIG. 1. SHOWING ARRANGEMENT OF WHEAT VARIETY TRIAL PLOTS AT ASHBURTON EXPERIMENTAL FARM, SEASON 1927–28.

The dark strips on each side are Hunter's (the check variety); left centre —Red Fife; right centre—Velvet x Solid-straw Tuscan. Photo taken just before harvest.

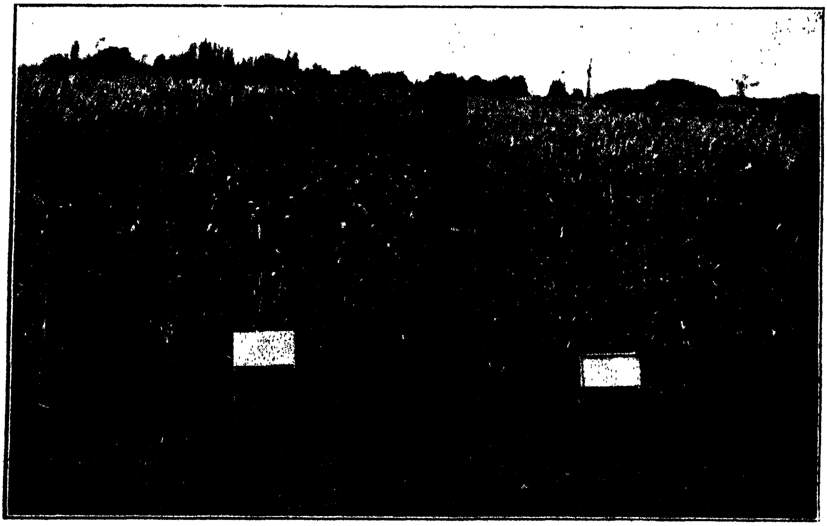

FIG. 2. ANOTHER VIEW ON THE PLOTS.

Left—Hunter's; right—Solid-straw Tuscan. The latter lodged slightly in places.

The most striking feature in Table 3 as compared with Table 1 is the reversal of form in Solid-straw Tuscan. In the earlier trials it was 1·7 bushels per acre worse than Hunter's, and in the later series 6·3 bushels per acre better. This may be explained in two ways: (1) The Hunter's and Tuscan used in the first trials were from ordinary commercial seed, and in the later trials were pure strains. It may be that the College strain of Solid-straw Tuscan is a greater improvement than was realized. (2) The more likely explanation is that the seasons preceding the harvests of 1927 and 1928 were specially suited to Tuscan. They were both years of unusually liberal spring rainfall, which has certainly been reflected in the yields of Canterbury as a whole, and which may have been specially beneficial to Tuscan. At any rate, the lower yields of Tuscan in the earlier trial should make us cautious of fastening too much hope on the extraordinary yields shown in the later one.

The most striking feature in the later series of trials considered by itself is the difference between the yield of Major as grown at Ashburton and the College in 1928. At Lincoln Hunter's beat Major by 3·3 bushels per acre, while at Ashburton Major beat Hunter's by 10·7 bushels. This can have no other explanation than that the soil or season at Ashburton was more suitable to Major than it was at Lincoln, and indicates the need of conducting variety trials of wheats in many localities instead of in one centre only.

Another important point in the trials is that in 1926 most varieties yielded less than Hunter's, while in the years before and after Hunter's was beaten in nearly every trial. The spring before the harvest of 1926 was very dry, the ground at Ashburton got very hard, and the yield of every kind of wheat tried was below 15 bushels per acre. Hunter's showed a superiority under these hard conditions that it did not manifest under more favourable conditions.

Further trials in several localities have been arranged for the season 1928-29.

INTRODUCTION OF TUNG-OIL TREES.

TUNG-OIL is in demand by the paint and varnish trade, which has hitherto drawn its supplies from China. As the supplies are now limited and irregular it is desired to obtain them from a more reliable source. The Department of Agriculture has recently arranged for the introduction of the tung-oil tree, which is deciduous and grows with little care on poor, rough hill country. The nuts contain about 58 per cent. of oil. The tree is expected to do well on the gum-lands of North Auckland and the poorer hill country of Nelson Province and similar places.

The plains and river-terraces of Central Otago have been built up of the softer portions of the metamorphic schists, forming deep mica-schist soil which responds in a wonderful way to cultivation and irrigation. The fertility of the soil is well known, and appears to be the outcome of a happy combination of physical and chemical characteristics. The soils of Otago taken as a whole are decidedly above the average in quality, and this appears to be owing to the great extent of mica-schist exposed at the surface, the decomposition of which has supplied more or less directly almost all the soil in the province. The fertility of these mica-schist soils appears to be mainly due to the large amount of available phosphoric acid present in them.

FROST-PREVENTION FOR ORCHARDS.

HEATING EXPERIMENTS AND METHODS IN CENTRAL OTAGO.

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CENTRAL OTAGO has always been subject to periodical late spring frosts of varying intensity, occurring during the flowering or setting periods of deciduous fruits, and doing injury to a greater or lesser extent. In most cases only a slight and useful thinning of the crop takes place. At times, at longer intervals, frost occurs which involves a light crop of one or more classes of fruit. At rarer intervals there is a real "old man" frost which wipes out most of the fruit crops in the locality. Such a one happened in the spring of 1926. On 16th September, when the apricots were in bloom, there was a blizzard which accounted for the whole of the apricots of the district, with the exception of a few very small favoured spots. On 13th October a frost, varying in intensity in different parts of the district from 8° to 13° F., visited the Central and lower Central areas which destroyed nearly all the remainder of the stone-fruit and much of the apple crop.

Such a serious, though temporary, setback soon found expression among the sufferers, and at a meeting of the Central Otago Fruit-growers' Association held in Alexandra it was decided to obtain all available information regarding methods and costs of frost-prevention. Having done this, it was still felt that as all the information collected (with the exception of a little from Hawke's Bay) was from the United States of America local tests were desirable to ascertain differences in climatic conditions and costs of appliances and materials. Accordingly the association approached the Government, and as a result a grant was made for such experiments through the Department of Agriculture.

The experiments were carried out in 1927, from August to November, and an account of the work is given in Part I of this article. In order to avoid unnecessary repetition, most of the material concerning the occurrence of frost, cost of preventive methods, description of appliances, &c., has been reserved for Part II, which will follow in due course. Some account will also be given of experiments carried out at Earnscleugh this year in the protection of the tomato crop against autumn frosts.

I.—THE 1927 EXPERIMENTS.

SITUATION OF EXPERIMENTAL PLOT.

After consultation with the Fruitgrowers' Association it was decided to carry out the experiments at the orchard of Mr. W. Bringans, of Alexandra. Our choice of site and owner proved to be a most happy one, for the former was admirably suited for the purpose, while nothing was too much trouble for Mr. Bringans and his family in their endeavours to render the experiments successful. The orchard is within half a mile of the centre of the Town of Alexandra, which is about 500 ft. above sea-level and situated in the fork formed by the confluence of the Manuherikia and Clutha (Molyneux) Rivers. The former comes in from the north-east and the latter from a north-westerly direction.

FIG. 1. VIEW OF PORTION OF MR. BRINGANS'S ORCHARD LOOKING TOWARDS HIS HOUSE (CENTRE)

The Crawford Hills show on the far left, and the closer hills are the Knobbies. Note the firepots on the experimental area.

[*Photo by K. Glasgow.*

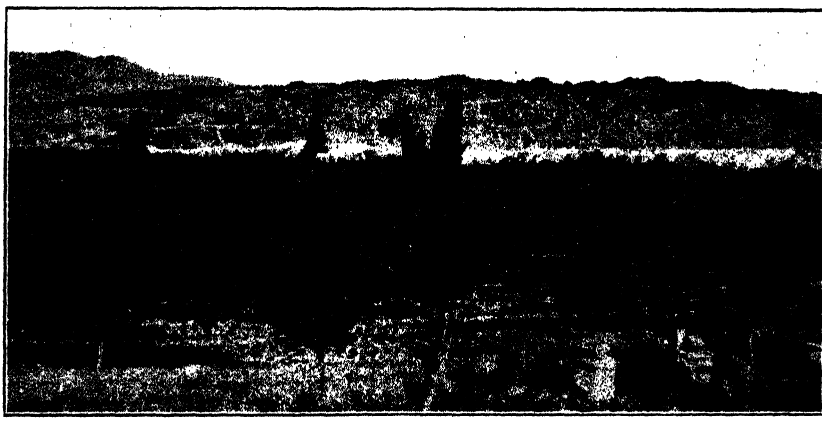


FIG. 2. VIEW OF MR. BRINGANS'S ORCHARD LOOKING SOUTH.

Note the bank of tailings showing white between the trees and the hill. The Clutha River runs from right to left of the photo between the tailings and the hill beyond.

[*Photo by F. Varney.*

The plain round the town is bounded on the north by the Dunstan Range, with the Old Woman Rock (Leaning Rock) north-north-west, 5,325 ft. On the east is the Raggedy Range, rising to 2,514 ft., and the Crawford Hills, rising to 2,128 ft. On the south the Knobby Range comes right to the Manuherikia River at the back of the town, rising farther back to Cairn Hill (2,106 ft.). To the west lies the Old Man Range, with the Old Man Rock, 5,507 ft., south-west of the town.

The portion of Mr. Bringans's orchard selected for the experimental area (which will be referred to as the "plot") is surrounded by fruit-trees, and consists of 1 measured acre of fairly old (but well-cared-for)

stone-fruits (apricots, peaches, nectarines, and plums), and is invariably more or less frosted annually. The ground was in good condition and, at the time, in bare fallow. The trees are fairly large, are planted diagonally, 13 ft. between the rows, with the same distance apart in the rows, which run E.N.E. to W.S.W. There are no live shelter-belts adjacent to the orchard, but on the south-west side between it and the Clutha River is a wide belt of stone tailings, 20 ft. to 25 ft. high, thrown up at the time of the gold-dredging boom and completely blocking the orchard from the river. According to levels taken by Mr. K. Glasgow for the Scientific and Industrial Research Department, there is not more than 9 ft. of fall from the highest to the lowest part of the whole orchard.

Preliminary Tests.

Although the main experiment was to " deal with 1 acre of stone-fruit during the whole of the critical period," a number of preliminary tests were necessary to ascertain rate of burning of the oil, where and how many pots were likely to be necessary, to test the alarm, to become conversant with conditions, and generally to get the " hang " of things.

The following tests (1) to (5) were made to ascertain the length of time various pots would take to burn a quart of oil, and tests (6) to (8) to determine the value of a process suggested by Mr. G. Moir, of Dunedin.

	Time per Quart.	Equals, per Gallon.
(1) Benzine-tin cut down to 8 in. high, open top	30 min.	2 hrs.
(2) Benzine-tin cut down to 8 in. high, one-third of top covered	35 min.	2 hrs. 20 min.
(3) Benzine-tin, full size, quarter of top covered	38 min.	2 hrs. 32 min.
(4) Lard-pail design, open top	45 min.	3 hrs.
(5) Lard-pail design, with circular spider ..	65 min.	4 hrs. 20 min.

(6) An experiment was conducted in Mr. Bringans's orchard at Alexandra on 8th September, 1927. Into a ½ cwt. paint-drum (in which holes had been punched and wire grating and spiral placed), forwarded by Mr. Moir for the purpose, was placed 5 lb. of Linton coal in small lumps (according to his instructions). On this was poured a mixture consisting of ½ pint Pintsch oil and ½ pint used crank-case oil. It was lit easily with a match with a small explosion. The oil in the bottom of the drum burned for 20 minutes with a good flame. The fuel was nearly all burned out in two hours. It was found that a reasonable heat was not generated until half the coal had burned away, but during the second hour's burning a good heat resulted.

(7) Another experiment was carried out immediately after No. (6) in identically the same way, but using Coal Creek coal in place of Linton. The results were exactly the same.

(8) On the same day another experiment was commenced. The drum was filled with Coal Creek coal and treated in the same manner as in Nos. (6) and (7). This was allowed to stand with a lid on the top in the orchard until 28th October (seven weeks). Every effort was made to light it at the end of this period with matches, but without success. Liquid fire (benzine and kerosene as used in the torch for lighting oil-pots) was then poured on the coal, this being tried twice

FIG. 3. TYPES OF HEATERS USED IN THE EXPERIMENTS.

On left—8-quart (10 American quarts) Bolton Lard-pail Heater, with circular spider and lid imported from United States. On right—heater with triangular spider and lid suggested by the writer as suitable for local conditions and made by a Dunedin firm; the lid could be improved by being a little deeper.

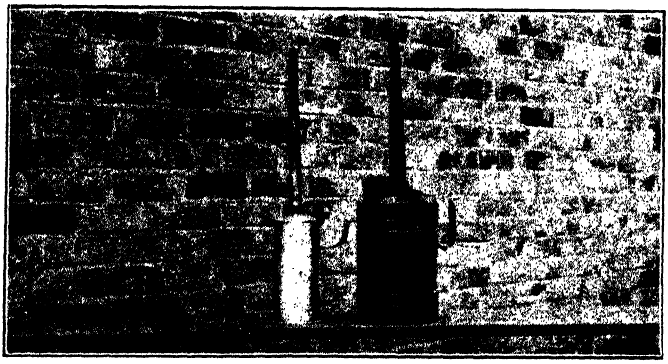


FIG 4. LIGHTING-TORCHES.

On left—2-quart torch suggested by the writer as being suitable for local conditions and made by a Dunedin firm. This is fitted with asbestos covered with fine mesh brass gauze at point of spout, and similar gauze at base of spout, to prevent explosions. On right—6½-quart (2 American gallons) torch imported from United States, fitted with asbestos wick in point of spout, the latter squeezed in to hold it. Gauze is fitted at the base of the spout.

[*Photos by F. Varney.*

without success. Trials were then made several times to ignite the coal by pouring the liquid fire directly on the oil in the bottom of the drum, but in each instance the lighting-fuel burned out without igniting any of the fuel in the drum.

Following are the conclusions come to regarding Tests (6), (7), and (8):—

(*a*) The absolute necessity for the pots to be charged and ready for lighting for six to eight weeks in the orchard proves conclusively the unsuitability of Pintsch oil as a lighting-agent—evaporation having taken place in the meantime.

(*b*) The generation of heat immediately after lighting is far too slow—at any rate, with the lignite and brown coal used.

(*c*) Once lit, even if required for only an hour, the whole charge must be consumed, whereas with oil it can be immediately extinguished.

(*d*) The extra labour required for refilling as compared with oil is too big a tax.

(*e*) Being so highly volatile and inflammable, Pintsch oil is too dangerous for the average man to handle under the conditions prevailing when an orchard is being heated.

(*f*) The fact that Pintsch oil is a strong weed-killer makes its use in the orchard dangerous to the trees in the event of any being spilled. Moreover, the odour is very objectionable, and hangs about for a considerable time.

FIELD-TEST NO. 1.

On the night of 8th August a small test in orchard-heating was carried out on the plot selected for the purpose in the presence of a few leading fruitgrowers. Four partially tested thermometers were placed as follows: A (check), 53 yards outside the plot to the north-east; B, inside the plot near the north-east corner; C, a little westward of the centre of the plot; D, near the south-east corner. All temperatures mentioned in this article, unless otherwise stated, were taken on partially covered stands (Fig. 6) at 4 ft. 6 in. from the ground, which is approximately the height in this and other countries at which standard temperatures are taken. Eighty benzine-tins were cut down about 2 in. and each provided with a spider or flame-spreader on the top, and a few 5-quart pots of the lard-pail type were put out. In each was placed ½ gallon of Tarakan fuel oil (B.I.O. Co.) having a specific gravity of 0·944 (equal to 237 gallons per ton weight). This oil was used throughout the experiments. The tins were evenly spaced between the rows of trees, those on the outside boundaries being placed a little closer. At 8.15 p.m. fifty tins were lit—namely, the whole of the outside row and every alternate ones besides. Each was allowed to be well lighted before the spider was put on. The lighting was done with a torch I had had made in Dunedin (Fig. 4, left), which holds 2 quarts, and the fuel used in which is equal parts of benzine and kerosene.

Following were the temperatures recorded, in degrees Fahrenheit:—

Table 1.

Time (p.m.)	8.15	8.45	9.15	10
Thermometers—				
A (check)	40	40	38	38
B	39	41	40	40
C	39	40	40	38
D	39	40	39	39

Unfortunately, the thermometers were not very accurate, but even so it appeared as if the temperature was raised from one to two degrees; it also felt as if the air was warmer inside than outside the area. After

9.15 p.m. the benzine-tins began to go out, and at 10 there was only an odd one alight. Although the experiment could by no means be called a good one, owing to the night not proving suitable, lessons were learned for future guidance. In particular it demonstrated the absolute futility of the benzine-tin as a commercial proposition in oil-burning for orchard-heating; the growers present were also entirely in agreement on this point. Even with a spider on, a gallon burns out in about two or three hours, leaving a pint, more or less, unburned. This is too expensive for the heat generated. The flame was very erratic, sometimes leaping up and at others not showing above the tins. Probably the shape is the trouble—square instead of round; moreover, benzine-tins are not now available in commercial quantities as they were formerly.

The few firepots of the lard-pail type, manufactured in Dunedin to my specifications, were an entirely different proposition. When we left the area at 10.30 p.m. they were all going strongly. The design was taken from illustrations of those used in America. The pot was a mass of flame which whirled round and ascended in a steady upright manner. The following are some of the results of the tests carried out with these pots, showing the rate of burning: Without spider, 1 quart took 45 minutes, equal to 3 hours per gallon; with circular spider, 1 quart took 65 minutes, equal to 4 hours 20 minutes per gallon. The pots appeared to burn too quickly without the spider, and with the circular spider (see Fig 3, on left-hand pot) there did not appear to be enough heat generated, and there was still ¾ pint left unburned with the latter, which with the spider removed took another 20 minutes to consume

It appeared, after numerous trials, that what was required was something between these two. After further experimenting I found that by cutting off the curve between the lugs of the spider and making an equilateral triangle (see Fig. 3, in front of right-hand pot) the following results were obtained: 1 quart took 1 hour 15 minutes to burn out, equal to 5 hours per gallon. To make sure, 1 gallon was lit up in the pot with this spider at 1 p.m., and at 5.45 p.m. it was still burning with 1 in. of oil still left in the bottom. Seeing that the heat weakens as the oil gets near the bottom, it appeared as if the 5-quart pot with the triangular spider should be burned for four hours, then with the spider removed there would be still left at least half an hour of good burning, thus giving a total good heating of at least four hours and a half.

As already stated, the growers present, like myself, condemned the benzine-tin, but were so taken with the 5-quart pot that the Central Otago Fruitgrowers' Association promptly decided to purchase eighty of these pots and triangular spiders, to be manufactured in Dunedin, and to be at the Department's disposal for our experiments.

FIELD-TEST NO. 2.

On 18th August Dr. E. Marsden (Secretary, Scientific and Industrial Research Department), Dr. E. Kidson (Director, Dominion Meteorological Office), and Mr. R. B. Tennent (Instructor in Agriculture) arrived, bringing with them a number of reliable tested minimum thermometers. The following evening another field test was made in the presence of these gentlemen and a number of growers. There had been a fall of

snow on the hilltops the previous night, most of the day was overcast, and during the test the sky was almost wholly obscured. The conditions, therefore, were quite unsuited for the purpose and unfavourable for orchard-heating. In this test the benzine-tins were discarded and replaced by the pots (Fig. 3, right) loaned by the Fruitgrowers' Association. These were placed in eight rows running approximately east to west, and containing nine pots per row. Lighting was commenced at 8.35 p.m., the whole being lit in 8½ minutes. The thermometers were in the same position as in the previous test. Following are the temperatures recorded, from which it will be seen that the thermometers in the plot were kept consistently from two degrees upwards above the outside check thermometer "A":—

Table 2.

Time (p.m.) ..	8.30	8.35	8.55	9.5	9.15	9.25	9.35	9.45	10.5	10.15	10.20	10.30	10.45
Thermometers—													
A (check) ..	36·5	All pots lit.	36·2	37·6	37·4	37·4	37·0	36·4	36·3	36·2	All spiders off.	36·1	36·2
B	36·5		38·0	39·6	41·1	40·5	41·5	41·5	40·0	40·1		40·3	40·5
C	36·0		36·8	39·0	39·5	39·4	39·4	39·2	38·5	38·5		39·1	38·4
D	36·0		36·5	39·0	40·2	41·0	40·0	39·2	39·0	39·0		38·2	38·0
Wind light ..	S.E.	..	E.	E.	N.E.	N.	N.N.W.	N.W.	E.	S.E.	..	E.	N.E.
Sky	Mostly overcast ..				..	Completely overcast.							

FIELD-TEST NO. 3.

On the night of 27th August another heating experiment was carried out on the plot in the presence of a large number of growers, with apparently disappointing results. The day had been overcast and calm until late afternoon, when it cleared and a cold southerly wind sprang up, which gradually died down towards evening, and frost set in. The thermometers were placed somewhat differently than in previous tests. The check A (standard one) was in the same position as before; B, C, D, and E (untested ones) were placed respectively in the north-east, north-west, south-west, and south-east corners, two pots each way inside the plot. F (standard one) was placed practically in the centre of the plot. No thermometer was nearer than 13 ft. from a fire.

At 9.30 p.m. thirty-eight pots were lit as follows: Nine in the top (northern) row, five in the bottom one, and four in each of the other six rows. Just after 10.30 p.m. an additional twenty-one were lit—namely, none in the top row, four in the second, three in each of the next five rows, and two in the bottom row, making a total then alight of fifty-nine. At 11.15 p.m. the remainder were lit. The position of the lighted pots was then as follows: Top row, sixteen; second row, ten; third to eighth rows, nine each; with an additional six on the front (east), making a total of eighty-six fires. It must be noted, however, that of the twenty-seven pots lit at 11.15 seven were in the top row and six across the front, thus leaving only fourteen additional inside ones.

The temperatures, and conditions of sky and wind, are shown in Table 3. Although it was practically calm outside the area, there appeared to be a drift from the directions indicated, but between the readings the wind might occasionally be from anywhere for very brief periods.

Table 3.

Time (p.m.) ..	9.25	9.30	10	10.30	10.35	10.45	11	11.15	11.30	12	a.m. 12.30
Thermometer —											
A (check) ..	31·5	38 pots lit.	31·5	31·5	Additional 21 pots lit.	29·5	30·5	Additional 27 pots lit.	30·0	29·0	28·0
B.. ..	31·5		31·5	31·5		31·5	32·0		32·0	32·0	30·0
C.. ..	32·5		31·0	31·0		30·0	31·0		31·0	30·0	28·0
D.. ..	33·0		32·5	32·5		31·0	32·0		32·0	30·5	30·0
E.. ..	32·0		31·5	31·5		31·5	31·0		30·0	30·0	29·0
F.. ..	32·0		31·5	31·5		30·0	31·5		32·5	31·0	30·0
Wind calm ..	S. drift	..	S.E. drift	S.E. drift	..	S.E. drift	S.S.E. drift	..	S.S.E. drift	S.E. drift	S.S.E. drift
Sky	Clear throughout the night.										

It will be noted that on the sides from which Mr. Bringans considered the frost comes—namely, north and east—additional protection was given, but, unfortunately, the drift came from the other quarter (south-east); one side (the front or east) only having the extra pots. Had additional ones been available for the bottom (south) row, possibly an improvement might have been effected.

Owing to the day being overcast, the soil would receive very little heat from the sun's radiation. I presumed, therefore, that inversion would be very poor. The result of this test was submitted to Dr. Kidson, and his reply may be quoted as follows:—

From the experience on the two nights when heating was carried out and what was told us in Alexandra, I should anticipate that the drifts during frosts at Mr. Bringans's orchard would generally be from the south and south-east. Your extra pots seem to have been of little value on 27th August. It is not surprising that the readings should be rather erratic on the edge of the area; the air-currents caused by the fires themselves might be responsible for that. The amount of heating was, however, disappointing, especially at the centre of the area. One would not have expected the conditions to be good owing to the facts that the sky was clouded until late afternoon and that there was a southerly breeze for some time thereafter. There would not be a marked inversion, probably, even by the time you finished your heating. It must be remembered that the coldest time is just around the dawn. Had you continued heating until that time the temperature of the orchard might have been kept considerably above that outside. On that Saturday night the minimum temperature fell to 21·2° F. at Ophir. I would suggest that you commence the next experiment at 2 or 3 a.m. I do not understand why we had such good effects on the night we were in Alexandra. There must have been some luck about it. There was one difference in the weather on the two occasions which might be significant: On the night we were there the upper winds were from the south-east; on 27th August they were probably from the west; and, in any case, there was little time for things to settle down, since pressure-changes were rapid. The westerlies may have sent down large masses of cold air from the mountain-tops. It is such points that have to be learnt from local experience.

FIELD-TEST NO. 4.

On 31st August Mr. K. Glasgow arrived under engagement from the Research Department to take levels in Mr. Bringans's orchard, and generally to take weather observations, &c. He was present and assisted me at the test held on 17th September, and I am indebted to him for his help and for recording temperatures.

Additional gear had now come to hand, consisting of fifty Bolton lard-pail heaters (as illustrated), one torch, and four Tycos minimum thermometers, all from America. Apart from these there were also standard thermometers and thermograph (self-registering thermometer) loaned by the Meteorological Office. These extra heaters and thermometers enabled me to put into operation a rearrangement in their positions which experience in earlier tests had suggested. Fig. 5 shows the approximate arrangement.

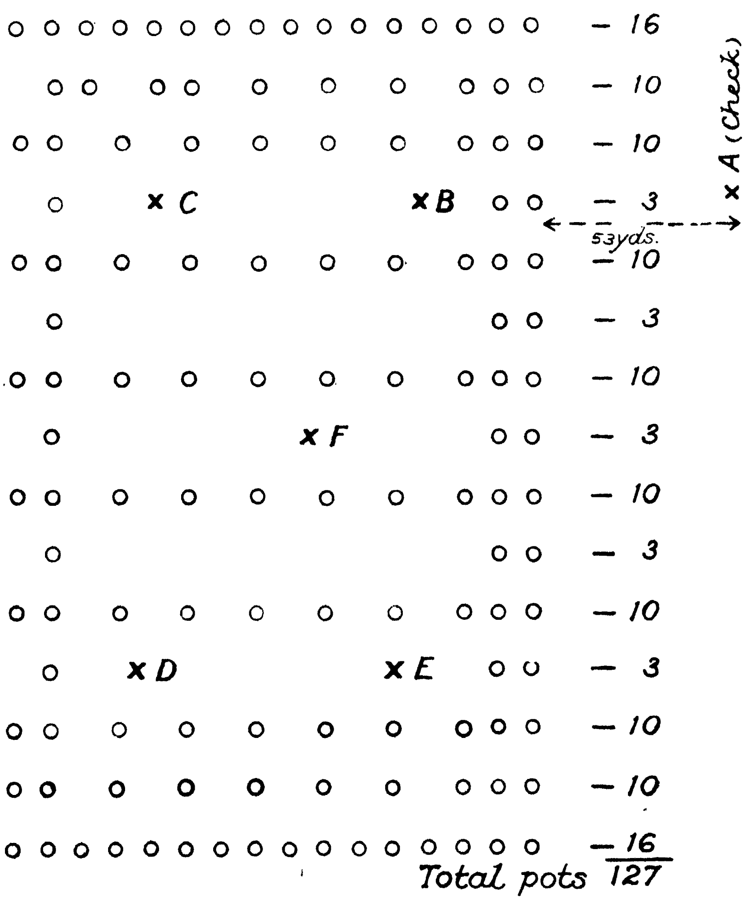


FIG. 5. DIAGRAM SHOWING APPROXIMATE ARRANGEMENT OF POTS AND THERMOMETERS ON MORNING OF 17TH SEPTEMBER.

Circles (O) denote firepots; crosses (X) denote thermometers.

The Tycos frost alarm was placed in Mr. Bringans's bedroom; the thermometer connected therewith by insulated wires is set to ring at 32° F., and was hung on a branch 3 ft. from the ground. Arrangements

were made with the Telephone Exchange to connect, after office hours, the telephone at Mr. Bringans's house with an extension telephone in my bedroom. On the morning of 17th September the frost alarm went off, and Mr. Bringans immediately rang me up. Accompanied by Mr. Glasgow I proceeded to the orchard, took temperatures, and immediately (2.55 a.m.) lit sixty-seven pots, the operation of lighting taking seven minutes. The first ones to be lit were approximately every alternate pot on the east and south sides, and then alternate ones throughout the plot.

The temperatures, condition of sky, wind, &c., are presented in the following table :—

FIG. 6. TYCOS FROST ALARM AND APPARATUS.

On left—frost alarm, which is usually placed in the bedroom and has only been put in this position for photographing. On right—thermometer screen, showing thermometer just below upraised lid. Low down on post is thermometer which causes bell to ring in bedroom when temperature of 32° F. is reached. Connecting-wires can be seen on the right.

Table 4.

Time (a.m.) ..	..	2.55	3.30	4	4.30	5.30	6	6.30	7
Number of pots lit	..	67	67	67	90	97	104	104	0
Thermometers—								Sunrise.	
A	Outside checks.	32·0	33·0	34·5	32·5	29·5	29·5	29·2	30·8
Ag	Outside checks.	31·5	30·0	30·0	29·8	29·0	29·5	29·8	31·0
A/10	Outside checks.	34·0	34·5	..	32·8	30·0	30·2	30·2	32·2
A/14	Outside checks.	33·0	34·5	..	33·0	31·0	31·2	31·0	32·5
B ..	..	33·0	35·0	..	34·0	30·0	31·0	31·0	33·0
C ..	..	31·5	33·5	..	34·5	30·5	32·0	32·0	32·5
D ..	..	33·5	37·0	..	34·0	32·2	32·0	32·0	32·5
E ..	..	33·1	37·3	..	38·2	33·0	32·0	33·0	35·0
F ..	..	32·2	32·0	36·5	35·7	32·2	32·5	32·0	32·8
Fg ..	..	31·5	32·0	34·0	33·0	30·0	31·0	31·0	32·0
F/10 ..	..	33·2	35·5	..	35·0	32·0	31·5	31·5	32·5
F/14 ..	..	32·5	35·5	..	35·0	32·0	31·5	32·0	33·0
Check (No. 5)	..	32·0	31·5	31·0	30·0	28·0	29·0	30·0	30·2
Wind—Calm	..	E.	S.E.	Nil	N.W.	N.W.	N.E.	E.	E.
Sky ..	..	Clear.							

FIG. 7. GENERAL VIEW OF EXPERIMENTAL PLOT, SHOWING ARRANGEMENT OF POTS.

[*Photo by K. Glasgow.*

Temperatures were also taken at different altitudes at stations A (outside check) and F (centre of plot), and are shown in the table as— Ground level, Ag and Fg; 10 ft. level, A/10 and F/10; and at the 14 ft. level as A/14 and F/14. An additional station, known as No. 5, was created as another check at a distance of 100 yards to the south-south-east of the plot. The latter was found useful on the present occasion, as the drift of air at one time for a short period veering round from the south-east to the north-west blew the warm air towards the A (check) thermometer and caused it to rise, as shown in the temperature table.

All the fires were put out at 6.45 a.m., with the exception of two rows on the eastern side. The spiders were taken off these, and they

FIG. 8. VIEW OF EXPERIMENTAL PLOT AT 3.30 A.M. ON 17TH SEPTEMBER, SHOWING POTS ALIGHT.

[*Photo by K. Glasgow.*

were left alight for another half-hour to allow of a smoke screen to be formed as a protection from the rising sun, as according to some authorities much of the damage is done by the sudden rise of temperature after sunrise. This protective screen is shown in Fig. 9.

There is no doubt as to the success of this trial, and the conditions more nearly approached those likely to be met with when heating is necessary to protect the crop. The blossoms of apricots were at this time about one-third out. When the fires were lighted about 3 a.m. the temperature had fallen to 32° F. Inside the heated area it was not allowed to go below this; it was kept at from 3° to 6° above the outside check thermometers, the lowest reading of the latter being 28° F. A very noticeable feature, and one which I think will appeal to growers more than the actual temperatures shown, is a comparison of the amount of hoar-frost showing on the trees inside and outside the plot.

FIG. 9. VIEW OF ORCHARD BEFORE SUNRISE ON 17TH SEPTEMBER.
Note heavy pall of smoke intended to act as a protective smudge against the rising sun.
[*Photo by K. Glasgow.*

All the trees outside the heated area carried a heavy layer of hoar-frost, some adjacent to but outside the plot even having miniature icicles on them where, through the change of air-current, the frost had been melted and again frozen. On the other hand, there was no frost on the trees in the plot, with the exception of one low-spreading apricot which had a light coating on the tops of the lower limbs.

Protective Experiments.

EXPERIMENT NO. 1.

On 4th October there was a light shower in Alexandra, with a light fall of snow on the ranges, and overcast sky most of the day. On the following morning at 1.5 a.m. the alarm went off. Lighting of pots commenced at 2 a.m., and within ten minutes eighty pots were alight. At 5 a.m. another twenty were lighted (sixteen on the eastern side and four on the south). At 6.10 a.m. a few fires were going out here and there, but were not relit; all were extinguished at 6.30 a.m. It was found at times, owing to sooting up, that it was necessary to give the

Table 5.

Time (a.m.)	1.45	2.10	2.45	3.15	3.45	4.15	4.45	5	5.15	5.45	6.10	6.15	6.30	6.45
Number of pots lit	..	80	80	80	80	80	80	100	100	100	100	100	Nil	Nil
Thermometers—											Sunrise.			
A ..	31·0	..	32·0	32·7	32·5	31·5	30·5	..	30·5	30·0	..	31·0	..	32·0
Ag ..	..	..	27·0	27·5	26·0	25·5	25·0	..	25·3	27·0	..	28·0	..	31·3
A/14 ..	[illegible]	..	32·0	32·7	33·0	32·5	31·5	..	32·0	32·5	..	32·0	..	35·0
B ..	32·0	..	32·5	34·0	32·5	33·0	31·0	..	32·0	32·5	..	33·5	..	39·5
C ..	31·0	..	33·0	34·0	34·0	33·0	32·0	..	32·0	[illegible]	..	32·5	..	34·0
D ..	32·0	..	32·5	34·5	34·0	33·8	32·0	..	33·0	31·8	..	33·0	..	35·0
E ..	31·0	..	34·5	35·0	34·0	33·6	32·5	..	36·5	36·8	..	37·0	..	35·8
F ..	32·0	..	34·1	35·0	34·5	34·0	33·0	..	33·0	32·5	..	33·0	..	34·0
Fg ..	31·0	..	32·0	33·6	32·5	31·8	31·0	..	31·8	31·8	..	32·0	..	35·5
Wind drift..	S.	N.E.	N.E.	E.	E.	S.E.	N.W.	..	E.	S.W.	S.	E.	..	..
Sky ..	Clear	..		..		..	..	..	Light cloud in E.	Cloud and smoke obscuring E.				

spiders a little raking with a stick to allow of better combustion and greater heat, this being more noticeable with the American pots with circular spiders. The alarm thermometer was lowered in this experiment to 2 ft. above the ground for safety's sake. The position of the pots was also slightly altered, as shown in Fig. 10, and they were left in this position for all later tests.

Temperatures, condition of sky, wind, &c., are shown in Table 5. From this record it will be noted that the temperatures were again raised several degrees above the danger-point.

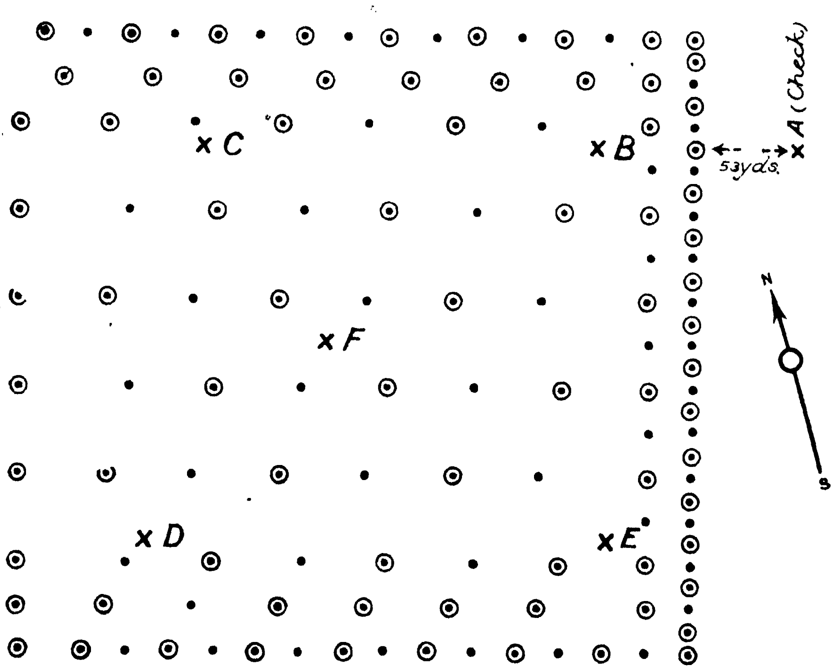


FIG. 10. DIAGRAM SHOWING POSITION OF FIREPOTS IN ALL THE PROTECTIVE EXPERIMENTS.

Dots indicate firepots; those marked with circle ⊙ would approximately be the first lighted.

EXPERIMENT NO. 2.

On 24th October the wind was southerly and bitterly cold, with scattered showers on the flats and snow low down on the hills, resulting in the alarm ringing at 2.30 a.m. on the 25th. As the temperature rose for a while after this, fires were not lit until it again commenced to recede—namely, at 4 a.m., when fifty-eight were ignited. As these were not holding the temperature an additional thirty-eight were lit at 4.45 a.m. with good results. All fires were extinguished at 5.45 a.m.

Temperatures, condition of sky, wind, &c., were as follows :—

Table 6.

Time (a.m.)	3	3.20	3.45	4	4.15	4.30	4.45	5	5.15	5.20	5.45
Number of pots lit	..	..	..	58	58	58	96	96	96	96	Nil
Thermometers—									Sunrise.		
A	29·0	31·0	30·0	..	30·0	29·0	..	29·7	..	29·0	..
Ag	..	27·0	..	..	27·5	..	..	..	..	..	..
B	..	..	27·0	..	30·0	28·5	..	30·0	..	32·0	..
C	..	..	28·0	..	28·0	28·0	..	27·0	..	30·0	..
D	..	..	28·0	..	28·0	28·0	..	29·0	..	30·2	..
E	..	..	26·0	..	30·0	29·0	..	29·5	..	31·5	..
F	..	32·5	31·0	..	31·0	31·0	..	32·0	..	32·6	..
Wind, drift	N.W	W.	E.	E.	N.	N.	W.	E.	N.	N.	..
Sky	Clear		..		..	..	..	Clouding in E.			

The condition of the trees at this date (25th October) was as follows : Apples — blossoms nearly off ; pears — blossoms all off ; quinces — blossoms commencing to fall ; apricots—well formed, calyces all off ; peaches and nectarines — fruit formed and one-third exposed, calyces loosening ; plums — about the same as peaches, with a few calyces right off ; cherries —calyces practically all off.

This frost did quite a considerable amount of damage in the district, in the lower-lying susceptible orchards, to all stone-fruits and some pears, quinces, and apples, especially Delicious. There was no damage done in the heated areas either at the experimental plot or elsewhere. The following notes from two other orchardists who fired on this occasion are interesting. Mr. J. R. Laing, Earnscleugh, states :—

The piece of ground is on a level with the highest part of the orchard, and is open on the north and east sides, protection being given from other trees on the west and south sides. At 3 a.m. on the morning of 25th October the thermometer registered 30° F. At 4 a.m. it had gone down to 29° F. The sky being clear I decided to light up, starting on the west side, and worked down the north side, then lit back to the west side again. All were lit by 4.15 a.m., and temperature in middle of block was 28° F. At 4.25 it was 29°, with the wind south-west and the sky clouding over. At 4.35 drift from west with temperature at 28°. At 4.40 drift from north, temperature 31°, with heavy clouds in the east, possibly the result of firing at Alexandra. At 5.10 drift from south-west and steady, with sky clearing slightly and temperature 30½°. All fires put out at 5.40, the temperature being 31°, with no drift, and the sky cloudy in the east. I had no outside record, as I had only one thermometer in working-order. The block fired consisted of 1¼ acres of apricots (180 trees). One hundred heaters were used, and they were placed in a double row round the north-west and south sides, the east side had a single row, and the balance were in alternate rows from west to east. Burning-time was about one hour and a half, and the oil used cost about £1 8s. On examining the trees I found that no damage was done on the west, north, and east sides. On the other hand, the trees on the south side, where the principal drift was from, were frosted about 4 ft. from the ground, and a double row of heaters on that side would have saved the crop. The heaters were taken in a fortnight after that, and a frost coming later undid the efforts of the 25th.

Mr. J. H. Hinton, Earnscleugh, reports :—

A block of greengages with a heavy crop of fruit was selected for the purpose. The trees are 19 ft. apart, and the block consisted of seven rows with seventeen trees in each row. Ninety-six pots were distributed over this area—viz., six rows

of sixteen pots; one row near the centre was not lit, except for the one at each end, thus making a total of eighty-two pots lit. The temperature dropped to freezing-point at 2 a.m. on 25th October. At 3 a.m. it was 29° F., so I decided to wait until there were four degrees of frost and then light up. Being inexperienced and the pots new, it was 3.45 a.m. before they were all finally burning, as they went out once; a ground frost of six degrees was registered at this time. After half an hour's burning the temperature rose three degrees, which was maintained until 4.30 a.m., when it rose to freezing-point, and at 4.45 a.m. the pots were put out. During the period that the fires were burning the air-currents were changing every few minutes. Whenever the currents changed it was noticed that there were icicles on the nectarine-trees adjoining. The result was found to be perfect, except for a few greengages on the lower parts of the trees in the outside rows. The nectarine block adjoining was badly hit, and a block of greengages on higher ground, which as a rule miss the frost, were partially frosted to the tops of the trees—*i.e.*, 10 ft. to 12 ft. high. A little over a quart of oil per pot was used for one hour and a quarter burning. The fires were watched from a terrace, and it was seen that the smoke drifted into all hollows in every direction for quite a distance.

Mr. Hinton adds the following note regarding the frost experienced on the morning of 14th November:—

After staying up all night watching the thermometer, at daybreak there was two degrees of frost only and a light wind blowing. Thinking, therefore, that the danger-point was passed I went inside, and was surprised at 7.30 a.m. to find that there had been seven degrees of frost on the ground between daybreak and sunrise. The damage was very extensive in the greengages previously saved. This proves the necessity of an alarm thermometer.

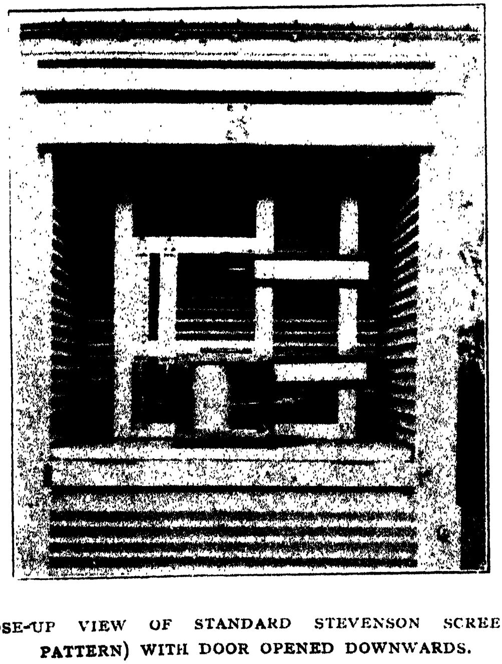


FIG. 11. CLOSE-UP VIEW OF STANDARD STEVENSON SCREEN (AUSTRALIAN PATTERN) WITH DOOR OPENED DOWNWARDS.

Showing, in front, thermograph; on right, maximum (top) and minimum (bottom) thermometers; and, on left, wet and dry bulb thermometers. The thermograph was one used in Scott's South polar expedition.

[*Photo by F. Varney.*

EXPERIMENT NO. 3.

After a spell of fine weather a change came on 10th November, most of the day being overcast, with a cold west to south wind blowing. That night snow fell on both the Old Man and Old Woman Ranges. The following day was bitterly cold, the wind being from the south; there was rain on the flats, and snow was falling on the Old Man Range. At 9 a.m. (11th November) the humidity was almost 100 per cent. and the temperature 47° F. The cold southerly continued until the middle of the afternoon, then died down, and the sun appeared. At 7 p.m. the sky was almost clear, the temperature being 50° F.; the maximum temperature for the day was 55° F. At 11 p.m. the temperature had lowered to 38° F., with prospects of a frost. However, the lowest temperature reached that night was 32·4° F.; this being at 1 a.m. on the 12th, after which the sky clouded over and the temperature rose. At 9 a.m. on the 12th the temperature was 39° F., and snow was falling on both ranges, with light rain on the flats. In the afternoon the weather warmed, resulting in the maximum temperature for the day being 64·7° F. At 7.20 p.m. the temperature was 59° F., the sky was mostly overcast, with low thick clouds in the west, but very thin elsewhere. The 13th was bitterly cold, with snow falling on the ranges, and most of the day and evening there was a fairly strong southerly blowing.

The temperatures hitherto quoted in this section (Experiment 3) all refer to those taken in the standard Stevenson screen (Fig. 11), and to co-ordinate them with outside temperatures under the ordinary 4 ft. 6 in. shelters (Fig. 6) they should be reduced from two and a half to four degrees. Also it should be pointed out that throughout this article standard times only are referred to.

As was expected, the frost alarm went off on the morning of 14th November. It rang at 3.45 a.m., the temperature at thermometer A reading 30·5° F. a few moments later.

Following are the temperatures, condition of sky, wind, &c. :—

Table 7.

Time (a.m.) ..	3·45	4	4·12	4·45	5·5	5·15	5·55	6
Number of pots lit ..	..	..	100	100	100	100	100	..
Thermometers—	Alarm rang.					Sunrise.		
A } Outside checks	30·5	28·0	..	27·5	28·8	29·0	33·0	..
Ag } Outside checks	..	25·0	..	24·5	28·0	26·0	..	..
B	..	29·0	..	32·0	34·0	..	37·0	..
C	..	29·0	..	32·0	33·0	..	..	..
D	..	28·5	..	32·8	35·0	..	..	..
E	..	28·0	..	33·5	34·5	..	..	..
F	30·2	28·5	..	33·0	34·8	..	37·0	..
Fg	..	..	..	32·3	32·0	..	..	..
Wind, calm ..	..	S.E.	N.E.	N.E.	N.E.	N.E.	N.E.	..
Sky	Clear.							

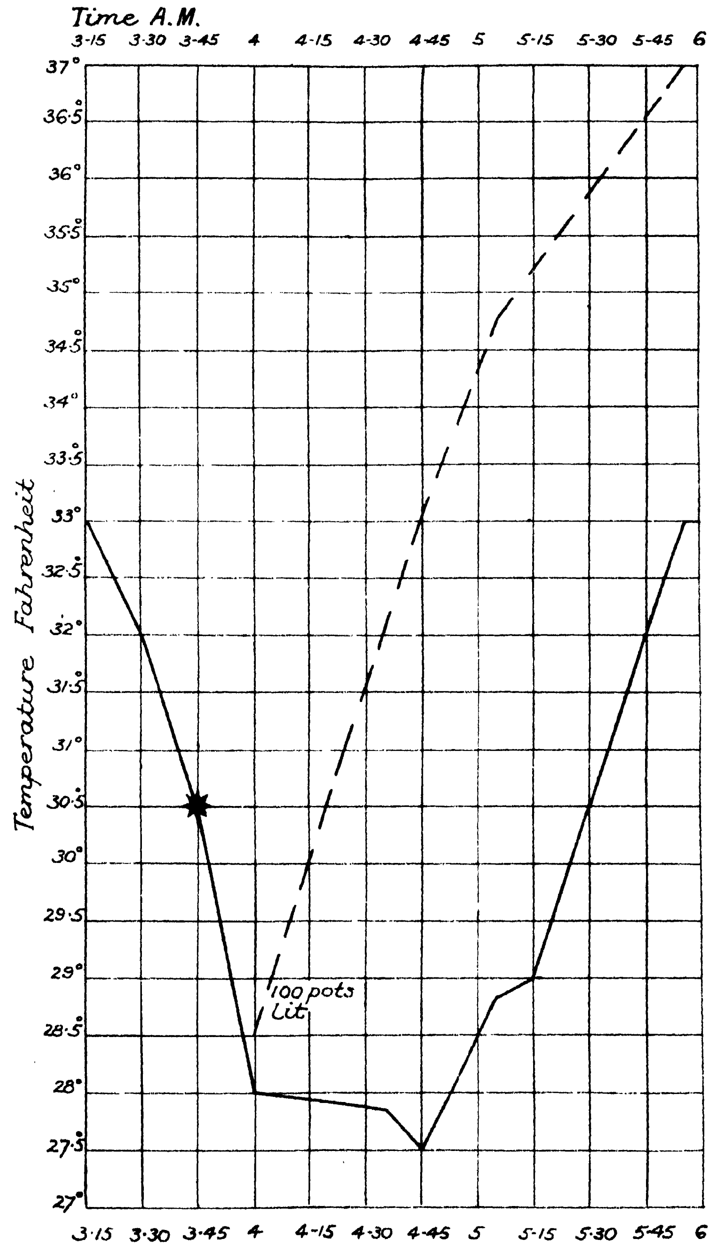


FIG. 12. GRAPH SHOWING TEMPERATURE MOVEMENTS IN PROTECTIVE EXPERIMENT NO. 3.

Lower (unbroken) line shows temperatures from 3.15 to 5.55 a.m. on 14th November, at Station A in Mr. Bringans's orchard. Broken line shows temperature in heated area. Star denotes time alarm rang. Note the sudden rise in temperature after lighting 100 pots between 4 and 4.12 a.m.

From Table 7 it will be noted that the temperature dropped two and a half degrees between 3.45 a.m. and 4 a.m. — namely, between the time the alarm rang and just prior to lighting up, also between 1.45 a.m. and 4.45 a.m. (three hours) it dropped ten degrees. This proved to be a dry "black" frost, which no doubt accounted for the sudden drop in temperature. The alarm thermometer had been placed for all these protective experiments, including this one, at a height of 2 ft. above the ground, and it had been found that at this height the alarm rang sufficiently early to give one ample time to reach the orchard and light up before the temperature had dropped too low; indeed, as will be seen from the reports of earlier experiments, one had to wait quite a while before lighting up.

With the phenomenally sudden fall in temperature experienced on this occasion it was evidently into the danger-zone before the fires were lit, for considerable injury was done by the frost, and this in spite of the fact that Mr. Bringans rang me up at my home immediately the alarm rang and that one hundred pots were lit by me within half an hour of that time. Had the alarm rung half an hour earlier the pots would have been lit by 3.45 a.m., when the temperature was only 30·5° F. It is quite evident that the injury was done before the fires were lit, because as the graph (Fig. 12) shows the temperatures were raised well above the danger-point in a very short space of time after lighting up. This view is further strengthened by the fact that Mr. Bringans, who also had some pots of his own, did not wait my arrival, but commenced firing his immediately, and there was certainly less damage on the portion he first fired. A "black" frost of this description is, fortunately, of very rare occurrence in this district; and, although firing did not entirely prevent injury, it must be admitted that its occurrence while experiments were being conducted was most opportune, for the lesson learned is a most valuable one.

EXPERIMENT NO. 4.

In view of the experience gained in the preceding experiment the alarm thermometer was placed still farther out in the open and lowered 3 in., making the mercury 1 ft. 9 in. above the ground. This had the desired result in causing the alarm to ring sooner than on previous occasions. It will have been noted that on the morning of the previous day the temperature at "A" thermometer was 30·5° F. as soon as it could be read after the alarm went off, whereas on this morning (15th November) the temperature at "A" registered 31·5° F. when the alarm rang, thus giving us longer time in which to get our fires going.

As there was every evidence of another frost, everything had been placed in readiness after the previous experiment. The alarm rang at 2.45 a.m. (15th November), but owing to some defect Mr. Bringans was unable to connect with me by telephone. He watched the temperatures for a while and then came for me at 3.30 a.m. The pots were lit at 4.15 a.m., and all were extinguished by 5.30 a.m. It was noticed that the trees outside the fired area were very white with hoar-frost; those within were mostly dry; a few were wet, but none had frost on them. The following table again demonstrates the fact that the temperature can be readily raised by firing.

Table 8.

Time (a.m.) ..	2·45	3·15	3·40	3·55	4·5	4·15	4·30	4·40	5·10	5·30
Number of pots lit	..	..	..	..	..	66	66	66	66	..
Thermometers—	Alarm rang.								Sunrise.	
A } Outside	31·5	30·5	32·0	31·0	30·5	30·0	30·2	30·0	30·0	..
Ag } check	..	28·0	30·0	29·0	28·0	28·0	28·5	..	29·5	..
B	..	..	..	..	..	30·8	..	33·0	34·2	..
C	..	..	..	..	..	30·0	..	32·0	32·2	..
D	..	..	..	..	..	30·0	..	33·5	34·0	..
E	..	..	..	..	..	30·5	..	34·6	35·5	..
F	..	..	..	..	..	30·5	33·2	33·8	34·0	..
Wind almost calm	..	..	..	..	S.E.	S.E.	N.E.	N.E.	S.	..
Sky	Few thin clouds.									

A DECEMBER FROST.

Shortly after this experiment, prospects of further frosts appearing to have vanished, all pots and other apparatus were removed and stored. This was only decided upon after very careful consideration by Mr. Bringans and myself. He considered that if another light frost came less damage would be done by it than by the neglect of cultivation and irrigation. These operations were impossible with the pots in position without a considerable amount of labour in moving them about and replacing them. Unfortunately, the exceptional happened, and another frost of six degrees was registered on the morning of 8th December, which did quite an appreciable amount of damage in some orchards.

I cannot close this part of the article without acknowledging the assistance and courtesy extended to me during these investigations. Among the foremost are officers of the Horticulture and Fields Divisions of the Department of Agriculture. Thanks are extended to Dr. Marsden and Dr. Kidson for much advice and the loan of valuable instruments, which rendered accurate readings possible; to the Otago Central Fruitgrowers' Association, both as a body and individually; to Mr. A. S. Duff for many nights' assistance in taking temperatures, &c.; to Mr. R. B. Tennent, Mr. K. Glasgow, and many others. The assistance and courtesies extended to me by Mr. Bringans and his family I have already mentioned; without their valued co-operation the work would have been far more difficult than it has been.

(To be continued.)

The Ragwort Moth.—The Noxious Weeds Control Committee of the Research Council has recommended that an open permit be now granted for the liberation of the ragwort moth (*Tyria jacobaea*), and that increasing supplies of this insect be imported, so that it may be extensively liberated in ragwort-infested areas next season.

IRON-STARVATION (BUSH SICKNESS) IN STOCK.

MORE FARMERS' EXPERIENCES WITH TREATMENT.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

SINCE the publication of the article on Iron-starvation in last month's *Journal* further satisfactory replies have been received from farmers in the affected districts regarding their experiences with iron-ammonium citrate, together with other practical points in the control of "bush sickness." A summary of these communications is given below. It may be noted that districts denominated by a letter used previously (see May *Journal*) are the same; where the letter is a new one the district has not been previously mentioned.

DISTRICT A.

Farmer "W" notes that it takes a fortnight to three weeks' treatment to effect a cure. He obtained good results in administering the scales to calves in their feed milk, enabling them to be reared. He finds that for cows the best method is to give the drug as a drench, as each animal then receives its proper dose. He also uses sulphate of iron in the drinking-water. He finds that the cost of this treatment is less than changing the stock to other districts, especially if the animals are taken in hand at the first sign of sickness. He has had no failures. He has also top-dressed his pastures with sulphate of iron, and given the cattle a lick composed of salt, bonemeal, and sulphate of iron.

Farmer "M" has used the iron scales as a drench for sick cows, and it has helped them to recover.

Farmer "G" found that for cows about a fortnight was the usual length of treatment required with the drug. Given as a drench after calving, he found it quite satisfactory. He finds that drenching is much cheaper and quite as effective as changing the cows to other districts. He has had no failures or bad effects, and finds that as a tonic iron-ammonium citrate is quite effective, that cows relish it, and that he can recommend it as a remedy for bush sickness.

Farmer "P" has had good results with a drench of 1½ oz. iron-ammonium citrate to 1½ pints of water, given once a day for eight days. He tried also sulphate of iron in the drinking-water, but did not notice any appreciable result. He and another farmer are of the opinion that good healthy change paddocks are the best for keeping stock healthy, although involving a higher cost. During the past season this farmer has not drenched with iron, but resorted to a lick of salt and bonemeal (equal parts) with about 1½ oz. of the iron scales. This is kept always before the animals, and with about two exceptions the stock have not shown any signs of sickness. The two exceptions were poor-constitutioned cows. He is top-dressing pretty heavily, which is improving matters. He remarks that if cows can be changed only during the off-season, as is the case with his farm, they need the iron lick to keep them healthy.

Farmer "D" has used the iron scales on sick cows, and finds a few weeks necessary to effect a cure. He has not had occasion to use any iron during the last two years. He finds that by top-dressing the paddocks with superphosphate and basic slag (the latter containing about 15 per cent. colloidal iron) and keeping the feed eaten down, the cows do not need a change as they did a few years ago. This, however, does not apply to sheep, as so far it is not possible to keep them in that locality any length of time before they begin to get sick.

DISTRICT H.

Farmer "G" uses iron-ammonium citrate mixed with bran to keep the cows healthy. Four cows are kept on the average, and they have not been changed to other localities for three years. The cost of changing four cows for six weeks each was £4 4s.; the cost of 3 lb. of iron-ammonium citrate was 11s. 3d.

DISTRICT I.

This locality is very near excellent change-paddocks. Farmer "T" says that, while he finds the changing of stock easily first as a positive insurance against all loss, the top-dressing with sulphate of iron is valuable in assisting the stock (dairy cows) to be milked the full season, without shifting in mid-season; also that the iron-ammonium citrate has its use in treating cows that have either been bought in or missed being changed. He intends making most use of the sulphate of iron, and has had better farming results since commencing to use it.

DISTRICT J.

Farmer "P," who gives the citrate of ammonium and iron scales mixed with bran and linseed nuts to milking cows, weaners, and heifers has found this treatment efficient. One heaped teaspoonful to 2 quarts bran and 1 quart nuts is the dose used. In the case of a sick cow, if she is not in calf the dose is half-teaspoonful of the scales dissolved in 4 oz. of molasses and 1 quart of warm water. If the animal will eat this ration, three weeks shows a marked difference. This farmer's communication may be quoted fully as follows:—

We teach our calves to eat a ration (with the drug) before we change over from fresh to skim milk. After the skim-milk stage they get a pinch of iron once a week until weaning. Then before going to the dry herd they get a half-ration twice a day for a fortnight. From then on we keep a careful watch and bring them in once a month for a week or even less—say, three days—for a full ration. We have used the drug in the troughs for the dry stock, but prefer the ration method, although in the drinking-water the drug has an equally good effect. It has this disadvantage—some animals drink so much less (or *vice versa*) than others. We can only change on our own farm; without the iron the stock go back. We have had *no* failures.

That your theory is a correct one I am fully convinced. I could write reams of my own experiments, but time is short, and your patience might be likewise; but I consider my experiments finished. I would like to try a dressing of iron oxide on one paddock and keep the yearlings in it exclusively, but cannot afford it. For four years I set aside two check weaners, two check yearlings, and two check cows. In every case I would wait until the disease was well advanced, then treat one with the iron and let the other die. In every case I was able to save the one. Although I used to keep

only heifers that were rejects for my experiments, it proved beyond my resources. But I think one experiment will interest you. I have one cow—Octavia—who has never eaten a ration and has never shown any signs of sickness, keeping always in splendid condition, but she had never had a robust calf until the last. During the time she was carrying it, during her fifth month and again during her eighth, I gave her a week's course of iron, half-teaspoonful, as in the case of a sick cow if she is not in calf. That calf was robust and hardy, and at five months was bigger than the previous heifer, who was exactly twelve months older, by the same sire.

I am enclosing photos. They show the value of iron on the offspring when given to the mother. This year I am giving Octavia no iron whatever to see what sort of calf she produces. The heifer—Hermione—I had the greatest trouble to rear; the last calf—Isthar—never gave me one minute's worry. Another thing, Hermione was nineteen months of age before coming into season; Isthar came in during her fifth month. That is another fact well worth noticing. When a female beast is sick or sickening she does not come into season, yet within four weeks of treatment we find them taking the bull.

Now for some adverse effects. When I started experimenting I overdid the dosage, and could not get my calves to hold. A local chemist put me right there; I borrowed his British Pharmacœpia, and between us we arrived at the reason; then I got at the minimum and worked up. Likewise, I get my bull fit before using; during the season I give him a half-dose of iron in his feed and have no trouble.

Of course, I use a lot of basic slag and super; I have also used White Island Product; also lime. But although I believe that with older pastures and top-dressing the sickness is greatly abated, I am still unable to be without the iron as supplied by your Department.

DISTRICT F.

Farmer "J" has cured several sick cows and calves with the iron scales. He finds that in the case of an adult beast it takes a total of about 1 lb. of the compound to effect a cure, this representing, at the approved dosage, a period of some two months. In the case of a young beast dosing for one week effects a cure. Dosing the animal with iron compares very favourably in his experience with the alternative method of changing stock to a non-sick pasture. He finds that while he grew turnips for the cattle very little sickness was experienced, but the last two seasons, having had no turnips, there has been quite a lot of trouble in his stock.

DISTRICT E.

Farmer "B" finds the method of dosing with iron-ammonium citrate very efficient with sick cows and calves, the usual length of treatment being fourteen days, given as a drench daily. He considers the method of giving the scales as a drench daily a cheaper method than "changing stock."

PRICE OF IRON-AMMONIUM CITRATE.

OWING to a reduction in the price of materials in England the Department has been able to reduce the charge for iron-ammonium citrate supplied to farmers in bush-sick areas from 3s. 3d. to 2s. 6d. per pound. Further, no additional charge will now be made for postage. These charges operated from the end of May.

PASSION-FRUIT AND ITS CULTURE.

W. H. RICE, Orchard Instructor, Auckland.

THE passion-vine is natural to most tropical countries, though most of the edible fruited varieties are native of Brazil. As found in their natural habitat the vines are most luxuriant and thrive best on the fringe of forests and in clearings, having a disposition to ramble over dead or decaying vegetation rather than mingle with heavy growth. The root-action is mainly restricted to heavy layers of decayed mould on the surface, rather than penetrating the heavy soil. In a state of nature it is very noticeable that the fruits are to be found on the extended tip growths only; the older parts of the vines form a dense mass of dry canes, the only wood of fruiting-value being the current season's extensions.

Of the fruiting varieties grown in New Zealand, *Passiflora edulis* and its varieties are the only ones so far proved of commercial value. These are the hard-skinned purple type. The ordinary *edulis*, given proper attention, produces fruits of good uniform size and well filled with pulp. The variation Mammoth, though nearly twice as large, cannot be depended upon to be so well filled and dries out more rapidly, becoming very wrinkled soon after picking. *P. Quitensis*, the pink-flowered, soft, cream-skinned, long oval-shaped fruit succeeds wherever the *edulis* grows. Though not grown to the same extent for commercial purposes, this variety is quite profitable and meets a fair demand.

Passion-fruit culture in New Zealand is restricted to the North Island and localities which are not subject to more than four degrees of frost. The vines come into bearing early, but are comparatively short-lived. The profitable bearing life of the plant may be considered to be from the second to the sixth year. *Passiflora edulis* is extensively imported into this country from Australia, and is yearly becoming more popular. The local-grown fruits are quite equal in quality, and the Australian importations mainly arrive after the local crop has been disposed of.

SOILS AND SITUATION.

Though not exacting as to soil-conditions, providing the drainage is good, passion-vines thrive best on light lands of good quality. Good drainage is decidedly the first essential, as the plants are very sensitive to stagnant water at the roots; but a good aspect, giving maximum sunshine with shelter from winds or the keen draught generated by shelter which does not reach to the ground, is also very necessary. The rows should run north and south or nearly, so as to give full sunshine both sides of the rows. The land should be well prepared by subsoiling, and worked to a fine state prior to planting, but if the land is rather heavy or deficient in humus a green crop, such as lupins or horse-beans, should be grown and turned in to improve the condition of the soil.

Owing to the comparative short life of passion-plants, they are very suitable subjects to grow as interplants with citrus-trees during orchard establishment. Land and situations suitable for citrus species may be regarded as suitable for passions.

PLANTING.

A suitable distance between rows will be 10 ft. to 12 ft.—according to the intended method of cultivation and implements to be used—with the plants 8 ft. to 10 ft. apart in the rows. Whatever method of training is decided upon, a substantial fence is necessary; adequate posts 5 ft. to 6 ft. out of the ground and 2 ft. to 2 ft. 6 in. in the ground, at 24 ft. intervals in the rows, should be put in prior to planting. If the overhead system of training is to be adopted, a 9 in. piece of 3 in. by 2 in. should be secured to each post, and No. 8 wire fixed to these on each side. Stakes are put in for each plant and secured to the top wires. The plants are trained up to the wires on a single stem by suppressing the laterals. Several leaders are then allowed to grow, these being trained along the wires. At intervals along these canes fruiting laterals are formed which hang down. When the fruit has been harvested the laterals should be cut back to within two buds of the base. These buds will supply next season's laterals, and so on year after year. The overhead system has an advantage in that the plants are readily pruned.

The overhead system of training is to be preferred for situations that are well sheltered, but in wind-swept or open areas the plants are considerably exposed by the elevation and readily damaged.

For the trellis system of training attach one No. 8 wire on top of the post, one in the middle, and one 9 in. above ground. Lace in these brushwood of a stability to last five years; or pig netting may be used. Train the leading growth fan-wise on to this trellis; from these shoots side fruiting laterals will be developed, which should be reduced to two buds after harvest, and so on season by season. This system, while not as tidy or allowing of such easy pruning as in the overhead system, gives greater fruiting surface and consequently more abundant crops. As the passion-vine bears the fruit on new wood only, if the pruning is not done annually tip extensions are made, which gves a luxuriant outer layer of vegetation and a mass of old canes and laterals on the inside. These tip extensions carry inferior fruit, and the old wood harbours disease and generally shortens the life of the plants.

PROPAGATION.

When the plants are to be raised *in situ*, seeds of selected fruits should be secured in season. After expressing the pulp it should be mixed with sand and dried, this being the most practical way to separate the seeds. On no account should they be washed, as seeds so treated invariably become infected with mildew. Seed-beds are prepared along the line of rows, and the seeds sown early in October as liberally to the clump as the quantity available will allow. As the plants grow they are thinned periodically, leaving the most robust each time, until by autumn they are single at the required intervals. Where the required care can be given, this method of establishment is to be preferred, as the passion-plant is a difficult subject to transplant without a high percentage of mortality.

TRANSPLANTS.

Plants removed from the open ground are rarely successful unless they have been wrenched at least twice during autumn and winter.

The best method is to sow the seeds in boxes during early October and transplant when large enough into other boxes, giving plenty of room to each plant—say, 4 in. by 4 in. The plants are then grown on and transplanted into the permanent quarters during spring or early summer, approximately a year after sowing. Care should be taken to avoid damage to roots or exposure at planting-time. For this reason pot-grown plants usually give greater satisfaction, though not as practical in a large way as box-grown.

CULTIVATION AND MANURING

Continued soil-disturbance must be maintained and the surface soil never allowed to compact unduly, otherwise the rootlets are suppressed and the plants languish.

Fertilizers are best applied just prior to the commencement of growth in early spring. A mixture of two parts superphosphate, two parts sulphate of potash, and one part blood-and-bone should be applied at the rate of 2 lb. for young plants and 4 lb. to 6 lb. for fruiting plants, distributed and worked in over the whole area and not only immediately around the roots. An annual ploughing should suffice. This should be confined to the land between the rows up to within 3 ft. of the plants, and should be done during May, a month before pruning is carried out. If these two operations are performed any nearer together than one month the plants are apt to be checked substantially.

INSECT PESTS AND DISEASES.

Insect pests of the passion-fruit are fortunately few. Mealey bug attacks the vine and causes some damage by withdrawing nutriment from the plant. When this pest is present the infestation is usually found on the fruit-stalk, and in this position the bugs take great toll of the sap which should feed the fruit, and thus considerably retard development. There are no practical ready methods of controlling this pest, and in the event of the plants becoming heavily infected they should be pulled up and destroyed. It is noticeable, however, that plants kept in good health, as free as possible from old worn-out wood and openly pruned, are least infected. The passion-vine hopper is usually associated with the plant, but damage from this insect is not severe, which is fortunate, as there is no reliable method of control.

Old foliage in the process of decay on the ground develops a mildew. This mildew often attacks the crown of the plant or the stem just above the ground, resulting in the death of the plant. Isolated plants only are lost in this way, so that the trouble is rarely noticed until too late. A surface dressing of sulphur, at the rate of about 3 cwt. per acre, along the base of the rows every midwinter is very beneficial.

During the last few seasons plants in some localities in North Auckland have been infected with a leaf-spot (*Septoria longispora*) which causes premature dropping of foliage and consequent malnutrition of fruit. While experiments with this disease have not advanced enough to allow a complete preventive or remedy to be prescribed, bordeaux mixture, 4-4-40, applied just before flowering and again prior to the fruit colouring, is giving good results. The

disease also attacks the canes and causes a stricture which checks the flow of sap. This form of attack may also cause considerable mortality among young plants It is, therefore, advisable to plant more in the rows than will be permanently required, and reduce the number as establishment becomes assured.

MANURING OF EARLY POTATOES.

EXPERIMENTS IN AUCKLAND PROVINCE, SEASON 1927.

T. H. PATTERSON, H.D.A., late Instructor in Agriculture, Auckland, and J. W. WOODCOCK, N.D.A., Instructor in Agriculture, Taumarunui.

AN initial report on three experiments conducted in Auckland Province during the season of 1926 was published in the *Journal* for March, 1927. The results obtained suggested further investigations, and questions which arose were: (1) How far could super profitably replace slower-acting phosphates such as bonedust and rock phosphate? (2) Could the total amount of manure used per acre be economically reduced? (3) What effect would the addition of soluble nitrogen have on the yield of the crop?

It had been found that bonedust could be replaced to a certain extent by superphosphate if the nitrogen was substituted by the addition of a soluble nitrogenous fertilizer. This, however, was the result as indicated by one season's experiments, and in order to further test this conclusion the two experiments commenced in 1926 at Pukekohe and Taupiri were repeated with certain modifications during the 1927 season. The fertilizer mixtures used were as follows:—

		Per Acre.
(1)	Superphosphate	15 cwt.
	Sulphate of ammonia	3⅛ cwt.
	Sulphate of potash	2 cwt.

		Per Acre.			Per Acre.
(2)	Bonedust	7½ cwt.	(3)	Super	7½ cwt.
	Superphosphate	7½ cwt.		Ephos phosphate	7½ cwt.
	Sulphate of ammonia	1⅝ cwt.		Sulphate of ammonia	3⅛ cwt.
	Sulphate of potash	2 cwt.		Sulphate of potash	2 cwt.

Instead of the pure bonedust used during the previous year, it was thought advisable to introduce a mixture (No. 1) in which the whole phosphate content was made up of superphosphate, but the amounts of potash and nitrogen were kept constant. In No. 2 mixture the nitrogen was present partly in organic form, and this difference in the form of nitrogen may have had some effect on the result.

The relative merits of organic and inorganic nitrogen on the potato crop were investigated during the year at Avondale, and the results of this experiment (which will be discussed later) have a direct bearing upon those under review.

Trial on Farm of E. J. Campbell, Pukekohe.

The field selected for this experiment adjoined that used last season, and, although the soil was very similar, instead of being ploughed out from permanent pasture it had been in temporary grass for two years,

following the rotation of two years cropping and two years grass adopted by the more progressive growers in the Pukekohe district. Consequently the supply of organic matter was not so good as formerly, although a fair turf was ploughed in. Sowing was done on 14th and 15th June, and, as in all the experiments under review, cut sets of the Gamekeeper variety were used for seed, being planted by hand and ploughed in with the manure.

There was no difference to be seen in the tops during growth, but owing to the excessive rains during July and August the yield suffered considerably, both from the wet conditions and through attacks of Irish blight, which practically defoliated the plants some time before harvesting.

When the crop was dug on 2nd and 3rd November the ground was very hard, due to lack of cultivation and the hot sun baking the ground surface after heavy rain. Strange to say there were considerable amounts of undissolved fertilizer still to be found under the plants, even after the ground had been saturated with the heaviest winter rainfall for a number of years. The yield was unusually light, as were most crops in the district. The middle row of each plot was dug by hand, and the tubers graded into first grade, second grade, and small. Potatoes were quoted at £17 10s. per ton for first grade and £7 10s. for second grade at that time, but in the subsequent tables no value has been placed on the small, unsaleable potatoes. Results for the experiment under review are tabulated below.

Table 1.—Results at Pukekohe (E. J. Campbell).

Type of Phosphate.	Yield per Acre.				Cost of Manures per Acre.	Value of Increase per Acre.	Profit per Acre.
	First Grade.	Second Grade.	Total.	Small.			
	Tons cwt. lb.	Tons cwt. lb.	Tons cwt. lb.	Cwt. lb.	£ s. d.	£ s. d.	£ s. d.
A. 15 cwt. super	2 5 70	0 19 22	3 4 92	12 0	7 18 8		
B. 15 cwt. super plus bonedust	2 1 49	0 18 35	2 19 84	11 51	9 0 4		
Difference in favour of A	0 4 21 S.	0 0 99 N.S.	0 5 8 S.	..	1 1 8	3 7 9	4 9 5
A. 15 cwt. super plus Ephos	2 4 61	0 18 83	3 3 32	12 71	9 3 0		
B. 15 cwt. super plus bonedust	2 1 49	0 18 35	2 19 84	10 83	9 0 4		
In favour of A	0 3 12 N.S.	0 0 48 N.S.	0 3 60 N.S.	..	..	2 8 6	2 5 10
A. 15 cwt. super	2 5 99	0 18 49	3 4 36	12 0	7 18 8		
B. 15 cwt. super plus Ephos	2 4 61	0 18 83	3 3 32	12 71	9 3 0		
In favour of A	0 1 38 N.S.	–0 0 34 N.S.	0 1 4 N.S.	..	..	0 18 9	2 3 1

S.=Significant difference; N.S.=Non-significant difference. (In the Statistical treatment of experimental results a difference is regarded as "Significant" where the chances are greater than 30 to 1 in its favour.)

Comments on Table 1.

The 15 cwt. superphosphate mixture has given an increase of 5 cwt. of saleable potatoes over the yield of the super plus bonedust plots. Allowing £15 as the net value per ton for first grade, after deducting the cost of digging and carting (£2 per ton) and adding the difference in the cost of manures, the profit derived by using the former has amounted to £4 9s. 5d. per acre. The remaining comparisons are not significant when treated statistically, and cannot be accepted with certainty, although super plus Ephos, as in the previous year, shows a slight superiority over super plus bonedust. Ephos phosphate, however, has increased in price since last year, and with a slight fall in the price of bonedust the former mixture has become more expensive than the super plus bonedust. The results obtained by eliminating bonedust altogether and by using wholly superphosphate, yet keeping up the nitrogen supply by the use of sulphate of ammonia, have been highly satisfactory even in a season when the rainfall was well above the average.

Farm of S. V. Bilkey, Taupiri.

The area selected for the experiment at Taupiri had been in pasture for a number of years, but the grass was not of good quality. The soil was slightly heavier than that on the field used for last season's experiment, and could not be got into suitable condition for planting until 6th and 7th August. On account of an error in mixing the manures it was found that the plots had received 4 cwt. of sulphate of potash per acre instead of the intended 2 cwt. On 8th November it was noticed that the 15 cwt. superphosphate plots appeared to be

Table 2.—Results at Taupiri (S. V. Bilkey).

Treatment.	Yield per Acre.		Cost of Manures per Acre.	Value of Increase.	Profit.
	Saleable.	Small.			
	Tons cwt. lb.	Cwt. lb.	£ s. d.	£ s. d.	£ s. d.
A. 15 cwt. super ..	9 1 16	13 72	7 12 6		
B. 7½ cwt. super plus 7½ cwt. bonedust	8 13 71	14 73	8 16 6		
Difference in favour of A	0 7 57 N.S.	..	..	3 7 8	4 11 8
A. 15 cwt. super ..	8 14 47	13 72	7 12 6		
B. 7½ cwt. super plus 7½ cwt. Ephos	8 2 74	13 15	8 7 6		
In favour of A ..	0 11 85 S.	..	..	5 6 0	6 1 0
A. 7½ cwt. super plus 7½ cwt. bonedust	8 13 71	14 73	8 16 6		
B. 7½ cwt. super plus 7½ cwt. Ephos	8 2 74	13 15	8 7 6		
In favour of A ..	0 10 109 S.	..	..	4 18 7	4 9 7

much more vigorous than the remainder, but this difference was not apparent when the crop was dug. The plots were harvested on 13th and 14th December, and the tubers were divided into "saleable" and "small." Results are presented in Table 2.

Comments on Table 2.

Super *versus* super plus bonedust: Although the 15 cwt. super mixture gives a fairly substantial increase over super plus bonedust, this increase is not significant when treated statistically.

Super *versus* super plus Ephos: When these two are compared there is a significant increase in favour of super, and the profit obtained by using the former amounts to £6 1s. per acre.

Super plus bonedust *versus* super plus Ephos: An increase of nearly 11 cwt. in favour of super plus bonedust is significant, showing a profit of £4 9s. 7d. per acre, although in this case the Ephos mixture is slightly cheaper. Although this comparison in 1926 gave a non-significant result, there was an increase in favour of super plus Ephos, but this was reversed during last season.

Residual Effect of Bonedust.

In the account of the results obtained in 1926 the question of the residual effects or "lasting" qualities of bonedust was discussed, and this was stated to be one of the reasons for the popularity of bonedust among potato-growers.

In order to test the residual effects of the manures used in the 1926 season, the areas at Pukekohe and Taupiri were sown with a main crop during November and December, 1926, respectively. The rows were arranged as far as possible to coincide with the rows of the previous crop, and a standard mixture of 7 cwt. manure was applied throughout. The crops were dug at Pukekohe on 23rd March, and at Taupiri on 1st April, but the differences obtained at both centres were not significant when treated statistically, and such differences cannot be attributed to any particular treatment. The results obtained at Pukekohe are given in the following table:—

Table 3.—Results of Second Crop at Pukekohe, 1926–27 (Farm of E. J. Campbell).

Treatment: Standard Manure plus—	Yield of Saleable Potatoes per Acre.	Difference in Favour of A.	—
	Tons cwt. lb.	Cwt. lb.	
A. Residues of 15 cwt. bonedust ..	6 9 30		
B. Residues of 15 cwt. super plus bonedust	6 6 38		
		3 1	N.S.
A. Residues of 15 cwt. bonedust ..	6 12 10		
B. Residues of 15 cwt. super plus Ephos	6 6 78		
		5 50	N.S.
A. Residues of 15 cwt. super plus Ephos	6 6 78		
B. Residues of 15 cwt. super plus bonedust	6 5 83		
		107	N.S.

A further attempt is being made at the two centres to test the residual effect of the manures used in the 1927 season.

Effects of Nitrogen : Trial on Farm of J. Capes, Avondale.

In the experiments at Pukekohe and Taupiri conducted over two years no account has been taken of the difference between organic and inorganic nitrogen, yet it may be that the difference in form of this element has had something to do with the superiority of the more soluble phosphates. Furthermore, the economical amount of nitrogen to apply to the potato crop has not been investigated, and while a small amount of available nitrogen is generally added to the potato manurial mixture there is no evidence to show that an increase in the amount used would not be beneficial, although it is the general tendency at Avondale to use more nitrogen in the mixture, chiefly as blood and bone, in lieu of bonedust.

An experiment was laid down at Avondale in 1927 to try the effects of increasing the nitrogen in the mixture, using it both in the form of dried blood and as sulphate of ammonia. To a basic mixture consisting of 7 cwt. superphosphate, 7 cwt. bonedust, and 2 cwt. sulphate of potash, per acre, were added: No. 1—2 cwt. sulphate of ammonia; No. 2—3 cwt. dried blood; No. 3—4 cwt. sulphate of ammonia.

The field used for the experiment had been previously cropped for two years with potatoes, and the soil was of the clay loam typical of the Avondale flats. Sowing was done on 2nd and 3rd August, and the seed, which was autumn-grown Gamekeeper, had been stored for some time in shallow trays. The tubers were planted by hand and carefully picked over, so that any which showed no signs of sprouting were discarded. All through the growing-period the tops of the rows which had received the heavier dressing of sulphate of ammonia could be easily distinguished, being more vigorous and greener than the rest.

The crop was dug on 23rd and 24th November, and the tubers were separated into " first grade," " second grade," and " unsaleable." This crop caught a rise in prices, and first grade were then quoted at 2½d. per pound and second grade at £11 per ton. Results are summarized in Table 4.

Comments on Table 4.

Sulphate of ammonia, 2 cwt., *versus* blood, 3 cwt.: Although the ammonia yielded 11 cwt. of first grade more than the blood plots, there was a greater proportion of second-grade potatoes in the latter, which reduced the difference in the total to 9 cwt. in favour of the 2 cwt. sulphate of ammonia. This represents a profit of £9 4s. 5d. per acre, after deducting charges for digging, commissions, &c., and the difference in the cost of the manures.

Sulphate of ammonia, 4 cwt., *versus* blood, 3 cwt.: The increase in favour of the larger amount of sulphate of ammonia is considerable, amounting to over 23 cwt., and this represents a profit of £18 14s. 3d. It is clear that at least a portion of the nitrogen supply should be in the form of sulphate of ammonia or other available form.

Sulphate of ammonia, 4 cwt., *versus* 2 cwt.: There is a total increase of nearly 16 cwt. in favour of the larger amount, which shows a profit of £11 16s. 9d. per acre. The good result obtained by increasing the amount of soluble nitrogen is therefore highly satisfactory, and it remains a very interesting question as to how much further the nitrogen can be increased and yet give profitable results.

Table 4.—Results at Avondale (J. Capes).

Comparison A *versus* B: Standard Manure plus—	Yield of Saleable Potatoes per Acre. 1st Grade.	2nd Grade.	Total.	Unsaleable.	Cost of Manures.	Value of Increase.	Profit.
	Tons cwt. lb.	Tons cwt. lb.	Tons cwt. lb.	Cwt. lb.	£ s. d.	£ s. d.	£ s. d.
A. 2 cwt. sulphate of ammonia	8 16 58	1 15 14	10 11 72	15 18	9 12 6		
B. 3 cwt. dried blood	8 5 56	1 16 91	10 2 35	10 12	10 6 0		
Difference in favour of A	0 11 2 S.	.. N.S.	0 9 37 S.	..	..	8 10 11	9 4 5
A. 4 cwt. sulphate of ammonia	9 12 18	1 15 14	11 7 32	7 65	11 8 6		
B. 3 cwt. blood	8 8 40	1 15 56	10 3 96	15 18	10 6 0		
In favour of A	1 3 90 S.	.. N.S.	1 3 48 S.	..	..	19 16 9	18 14 3
A. 4 cwt. sulphate of ammonia	9 12 18	1 15 14	11 7 32	7 65	11 8 6		
B. 2 cwt. sulphate of amomnia	8 15 60	1 15 101	10 11 49	10 12	9 12 6		
In favour of A	0 16 70 S.	.. N.S.	0 15 95 S.	..	..	13 12 0	11 16 9

Importance of Seed-selection.

Although the first few weeks were very unfavourable to growth, the yields from the plots at this centre were most encouraging. This could not be attributed to manuring alone, nor to any great superiority of soil, but it may have been due in large degree to the sprouting of the seed in trays. Any tuber showing weakness of the shoot or any disease was discarded, since every tuber was examined when planted. This laborious method of planting will be quite justified, especially on land valued at £200 per acre, which should be treated intensively in every way. It is to be deplored that more care is not exercised in the storing and selection of seed-tubers than is usually the case in the early-potato districts.

Quantity of Manure : Trial on Farm of C. Austin, St. Heliers Bay.

The question often arises as to whether the amount of fertilizer applied to the potato crop, which is often round about 1 ton per acre, could not be reduced. It has been previously mentioned that both at Pukekohe and Taupiri, where up to 1 ton per acre of manures was used, that even after the heavy rains during the winter of 1927 there appeared to be large quantities of manure left in the ground after digging. It might be possible therefore to cut down the amount of manure applied to the crop without seriously affecting the yield, and thereby reduce the cost of production, since the manure bill is often from one-fourth to one-fifth of the cost of growing the crop.

An experiment conducted at St. Heliers Bay in 1927 was designed to try the effects of reducing the amount of a manurial mixture. The mixture used was made up of five parts (by weight) of superphosphate, five of bonedust, and two of sulphate of potash. Of this mixture 7 cwt., 10 cwt., and 15 cwt. per acre were used on the respective plots. The area on which the trial was conducted was composed of dark volcanic loam, and it had been cropped with potatoes for the two preceding years. The crop was planted on 19th and 20th July, and harvested on 21st and 22nd November. During the growing-period no marked difference was to be seen between the plots. At the time of digging, first-grade potatoes were selling at 2½d. and second-grade at 1d. per pound. Results are given in the following table:—

Table 5.—Results at St. Heliers Bay (C. Austin).

Amount of Mixture used.	Yield of Saleable Potatoes per Acre. Total.	1st Grade.	2nd Grade.	Unsaleable.	Cost of Manures.	Value of Increase.	Profit.
	Tons cwt. lb.	Tons cwt. lb.	Tons cwt. lb.	Cwt. lb.	£ s. d.	£ s. d.	£ s. d.
A. 10 cwt. ..	6 3 56	5 3 50	1 0 6	11 70	4 18 4		
B. 7 cwt. ..	5 13 43	4 14 96	0 18 59	11 41	3 8 10		
Difference in favour of A	0 10 13 S.	0 8 66 S.	0 1 59 N.S.	..	..	7 17 2	6 7 8
A. 15 cwt. ..	6 7 82	5 7 92	0 19 102	11 98	7 7 6		
B. 10 cwt. ..	6 3 56	5 3 50	1 0 6	11 70	4 18 4		
In favour of A	0 4 26 N.S.	0 4 42 S.	.. N.S.	..	..	3 12 4	1 3 2
A. 15 cwt. ..	6 7 82	5 7 92	0 19 102	11 98	7 7 6		
B. 7 cwt. ..	5 17 16	4 15 89	1 1 39	11 41	3 8 10		
In favour of A	0 10 66 S.	0 12 3 S.	.. N.S.	..	..	9 10 0	5 11 4

Comments on Table 5.

10 cwt. of mixture *versus* 7 cwt.: The larger application of manure has resulted in an increase of over 10 cwt. of saleable potatoes, which represents a profit of £6 7s. 8d. after deducting digging costs, auctioneer's commission, and the difference in cost of manures.

15 cwt. *versus* 10 cwt.: While there is an increase of over 4 cwt. of first-grade potatoes in favour of the larger dressing of manure, the difference in total yield is not significant, but there is sufficient evidence to show that at 15 cwt. the limit of manuring has apparently not been reached. The application of 15 cwt. shows a profit of £1 2s. 3d. over the 10 cwt. dressing after deducting the difference in cost of the extra manure.

15 cwt. *versus* 7 cwt.: The larger amount gives a difference of over 12 cwt. of first-grade tubers, which is highly significant, although the 7 cwt. dressing gives more second grade, which brings down the difference in total to 10½ cwt. The profit derived by using the heavier dressing amounts to £5 11s. 4d. per acre. It appears, therefore, that

the amount of manure cannot be reduced to any advantage below 15 cwt. under conditions similar to those pertaining in the 1927 season.

Conclusions.

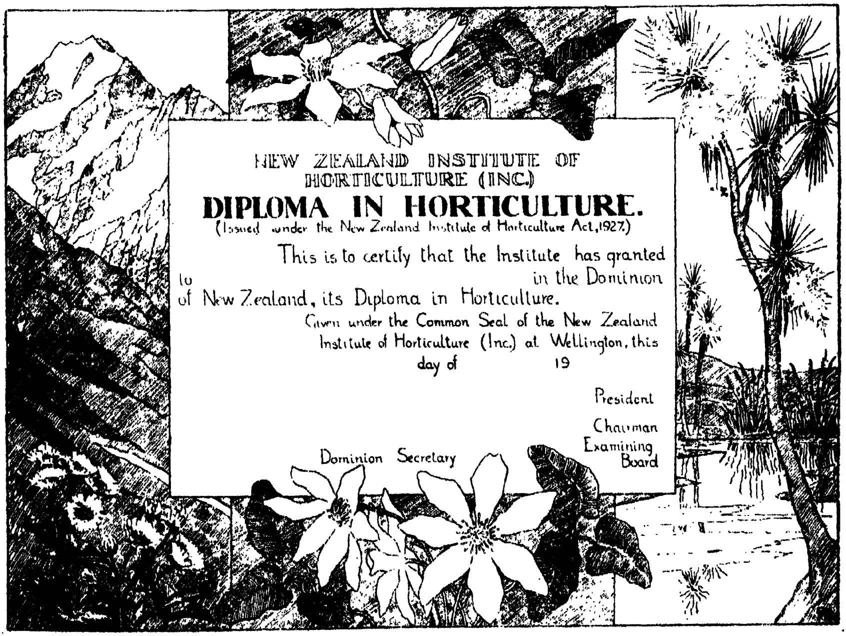
As in the previous season, the results obtained in 1927 go to show that the bonedust can be reduced in the mixture, and can be replaced partly and in some cases wholly by cheaper phosphates—particularly super—provided that the nitrogen supply is kept up.

The use of soluble nitrogen, in the form of sulphate of ammonia, gives better results than dried blood, and an increase in the amount of the former has been responsible for an increase in yield. This matter needs further investigation.

The large amounts of manure at present applied to the potato crop cannot be reduced to any great extent without decreasing the yield.

It is clear that results secured by one or two years' trials must be accepted only tentatively, as results vary from season to season. Other experiments in New Zealand and beyond also show the same to be true. It is desirable, if not actually necessary, to carry on the trials for, say, five years, before finality can be hoped to be reached for some innovation working out better than long-established farm practice. This is the time-period which is being aimed at in this series of trials.

We again tender the growers—Messrs. E. J. Campbell, S. V. Bilkey, J. Capes, and C. Austin—our thanks for their co-operation. We also acknowledge the help rendered by colleagues of the Fields Division.



REDUCED REPRODUCTION OF THE INSTITUTE OF HORTICULTURE'S DIPLOMA FORM.

A NEW DRINKING-WATER SYSTEM FOR POULTRY-HOUSES.

L. W. C. COCKER, Poultry Instructor, Wellington.

IN designing and laying out a system for supplying drinking-water for poultry the first care should be to see that it will meet all the various requirements for watering the stock in a hygienic manner.

Undoubtedly the most important requirement is that the water shall at all times be as pure and fresh as possible, for it can be well understood that impure drinking-water not only leads to impaired health in the stock, but also has an undesirable effect on the egg-product. The logical conclusion, therefore, is to avoid any system wherein it is possible for the water to become contaminated with litter, droppings, &c. In addition, the system should be such as to eliminate the spilling of water by the birds, and thereby keep the litter as dry as possible, for damp floors and litter are not favourable to the health of poultry. Further, such conditions are favourable to disease and the spread of intestinal parasitic life. The question of how to avoid intestinal parasitic infection of poultry is of great importance. Mortality from this cause is more extensive than commonly realized, while the economic loss through unthrifty flocks due to the ravages of these parasites is also considerable.

Another important matter to be considered is economy of labour. Consideration given to this point is time well spent, for it is well to remember that a poultry plant is not erected and equipped for a few weeks or months, but with a view to providing a partial or whole livelihood for the owner. In the case of the side-line poultry-keeper a great deal of the care of the flock usually falls on the womenfolk of the home, and if for no other reason the work of watering the flock should be made as light as can be. In the system here described the writer has given this aspect of the matter some thought, and endeavoured to meet the needs of the commercial poultryman as well as the side-line poultry-keeper in designing an efficient and practical system within the reach of both, and inexpensive as regards its initial cost or upkeep.

Firstly, as regards a pure water-supply free from contamination, this has been provided for as far as possible in that the tank is placed in such a position that the fowls have to fly up to a lattice platform before being able to secure water. Secondly, each pen has its own supply and overflow of waste, for the reason that should an epidemic of roup, chicken-pox, or other poultry ailment break out it is much easier to overcome the trouble than where the water runs from pen to pen, supplying each house with the overflow of the one before. Thirdly, the keeping-quality of eggs produced and properly gathered on plants where the water-supply is as it should be is very much better than where the fowls are allowed to drink water of a questionable nature.

The accompanying photographs were taken at the Wallaceville Poultry Station, where the system is working quite satisfactorily. The water is brought into the plant by a ¾ in. main, and runs through the houses on the under side of the ceiling rafters. At the junction of each

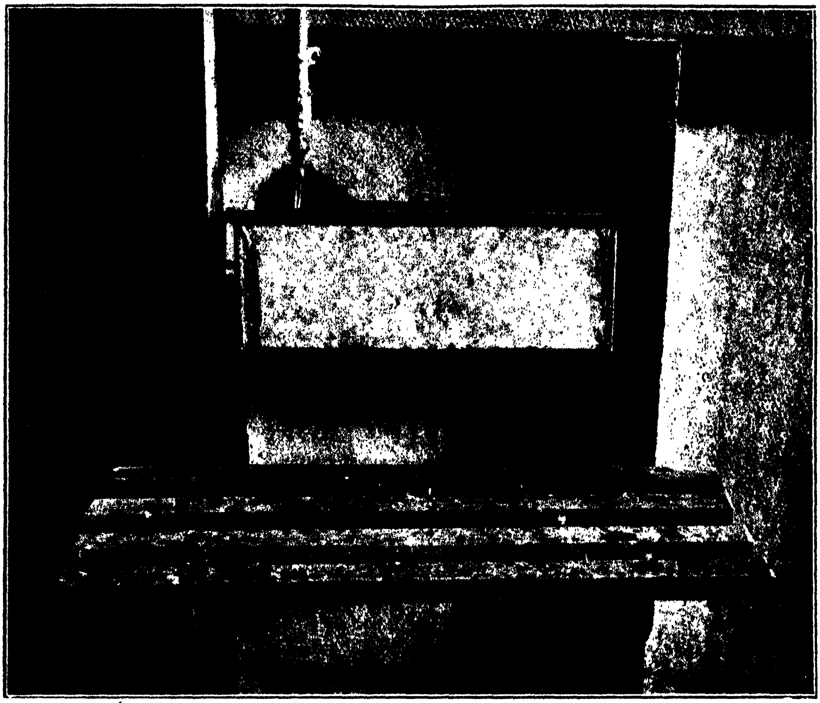


FIG. 1. ONE OF THE DRINKING-TANKS, SHOWING DRIP METHOD.

This tank is serving two compartments in the house. Platform for the birds is seen in front.

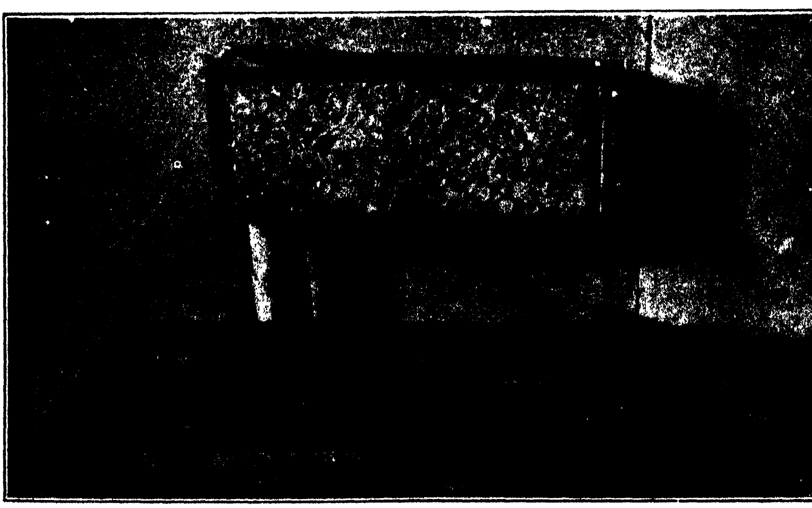


FIG. 2. THE SAME TANK SEEN FROM OTHER SIDE OF PARTITION.

In this view the waste-pipe is seen below tank. Note also triangular piece of iron across left corner of tank to protect waste-plug.

[*Photos by H. Drake*

partition wall there is a ½ in. reducing T joint, and from this point the water is led to the tank by a ½ in. pipe, on the end of which is screwed a small gas-tap similar to those used for gas-rings, &c. This tap when turned on can be adjusted to supply all requirements from a drip to a small jet of water—quite ample for the desired purpose. The platform for the fowls to drink from is fixed 2 ft. from the floor, and is 10 in. below the top of the water-tank. The lattice platform should not be too wide—from wall to outer edge, 13 in. by 2 ft. long, will be quite sufficient—so that the birds cannot move away from the tank and spill drops of water, making the floor of the house wet and damp. Further, there is not room enough to induce birds to congregate, with a corresponding trouble from resulting droppings. The tank itself may be fitted to protrude through the partition, thus supplying two compartments instead of one. In the event of necessity one side can easily be shut off by simply laying a 5 in. piece of tin or board over the top of the tank. The double tank is 15 in. by 10 in. by 5 in. deep.

FIG. 3. SINGLE TANK, SHOWING WASTE OUTLET AND PLUG.

For the purpose of the illustration the overflow-plug has been moved and reversed to show escape holes in bottom.

[Photo by H. Drake.

In the bottom of the tank, toward the rear wall end, just sufficiently far away from the centre-line to allow of the overflow waste-pipe running along the partition wall on its course to the rear wall of the house, is soldered a 1¾ in. waste-plug fixing. On the plug itself is soldered a round piece of 1½ in. galvanized piping, which when inserted in the plug fixing should be ½ in. below the level of the top of the water-tank. Three ¼ in. holes are bored in the plug, which allows the overflow of water to escape. On the bottom of the tank a small sleeve of galvanized pipe is soldered, to allow of a slip-joint into the larger waste-pipe leading out of the house. A rolled lip is provided on the front of the tank, with a tilt upwards to divert back into the receptacle any drops which may fall from the wattles and beak of a bird. A small three-cornered piece of sheet iron is soldered across the corner of the tank immediately above the waste-plug, so as to prevent the birds interfering with the plug, in which case the tank would remain empty.

If an occasional inspection and ordinary attention are given to the taps to prevent any clogging, by allowing the taps to free themselves by turning full on, this system will be found useful, sanitary, and very labour-saving.

CONTROL OF BROWN-ROT IN STONE-FRUITS.

EXPERIMENT WITH PEACH-TREES AT HENDERSON, 1927–28 SEASON.

Horticulture Division.

THE experiment on the control of brown-rot fungus (*Schlerotinia cinerea*) which has been carried out over a period of several years in co-operation with Dr. R. H. Makgill, in his orchard at Henderson, near Auckland, was continued throughout the past season. The treatment on this occasion was a repetition of the programme carried out during the previous year, and published in the *Journal* for October, 1927.

The results as regards fruit-rot were better in all sections, probably owing to the drier summer weather experienced, although this improvement was not noticeable in stone-fruit orchards in the same locality where little or nothing was done to control this fungus. While the results showed a general all-round improvement, the relative merits of dry mix sulphur, Sulpho, and atomic sulphur remained the same. The amount of fruit-rot infection was ½, 1 to 2, and 5 to 7 per cent. of the crop respectively, while on the check trees (which received only the first three applications of spray) the respective losses were 3, 5, and 9 per cent. Trees receiving little or no attention in other orchards in the locality lost 40 to 60 per cent. of fruit.

All through the season a decidedly better general condition of the trees receiving dry-mix sprays was evident when compared with blocks of trees receiving other treatment. This was so marked that the owner of the orchard has decided that the best results over many seasons of experimentation were secured by this spray, and it is worthy of adoption as a routine treatment.

It is important to remember that for the last nine years strict orchard sanitation has been observed in this orchard. No infected fruit has been allowed to remain on the trees or come in contact with other fruit in the containers used for harvesting, and all infected fruit has been promptly destroyed. During pruning all diseased or doubtful wood was removed and cleared away, not even small twigs were allowed to remain on the land or be turned under.

The recipe for the dry mix spray used is as follows :—

Take 16 lb. fine powdered sulphur, 5 lb. fresh rock lime, and ½ lb. casein. Wet the casein and dissolve it with ½ pint of caustic-soda solution. Stir well, and bring the mixture to the consistency of milk by making it up to 1 gallon with water (caustic-soda solution is made by dissolving 1 lb. caustic soda in 1 gallon of water). Sift the sulphur and make it into a paste with water ; add the gallon of dissolved casein and as much more water as is necessary to bring it to the consistency of cream. Slake the lime carefully and dilute the milk to 10 gallons with water. Strain it into the spray-tank, start the agitator working, add the "creamed" sulphur, and make the spray up to 100 gallons with water.

SOME POINTS IN SEED-TESTING.

N. R. FOY, Seed Analyst, Biological Laboratory, Wellington.

THE GERMINATION TEST IN RELATION TO VALUE.

MANY merchants and farmers are inclined to regard the germination test as the most important indicator of value in seed, and in some respects this is true, for no matter how pure a line of seed may be if there is no growth the value is nil; moreover, when one considers that most good-quality seed is highly machined this view is not unreasonable. However, both purity and germination must be considered in accurately assessing value.

Germination is the capacity of the seed to grow to produce normal plants. High germination means high seed-vitality, and high vitality means success in the competition which must arise with other plants—either sown or present in the soil—and ability to withstand adverse conditions. Seed-vitality is measured by what is known as the germination-speed—that is, the speed in which growth commences after the conditions necessary to germination have been applied. To illustrate this point, two lines of turnip-seed may both be represented with a total final growth of 92 per cent. in ten days—one with a four-day growth of 90 per cent., and the other with a four-day growth of 65 per cent. The first line is one of high vitality, and, should adverse conditions such as drought or weed competition arise after sowing, will stand by far the better chance of returning a successful crop than the low-vitality line, a great number of the plants of which would succumb to the same conditions. Purchasers, then, should demand seed not only of a high growth but of a high vitality, a point which is frequently ignored by farmer and merchant alike.

The germination percentage of seed is dependent upon several factors, and varies among different species. A percentage which is poor for one species may be good for another, and farmers should make themselves acquainted with the approximate standards for the different varieties of grass and clover which they handle. The main factors are as follows:—

(1) The degree to which the line has been dressed: This refers more particularly to cocksfoot, average samples of which contain 15 to 25 per cent. of empty seeds incapable of growth, and whose germination percentage, therefore, rarely exceeds 80 per cent.—a figure which is low for crested dogstail or clovers, where there are no empty seeds present.

(2) The age of the seed: Some seeds retain vitality over a considerable period of years (white clover especially), but in the majority of seeds vitality commences to decline about twelve months after harvesting, and after two years the germination percentage is rapidly falling, or in some seeds will be almost nil. The ability to retain vitality is dependent to a large extent upon the degree of maturity of the seed when harvested. The more complete the maturity of the seed the longer will the seeds retain their vitality. The germination speed, besides indicating vitality, is thus also an indicator of age and maturity.

Farmers, however, may be well advised, as a general rule, to procure seed of the current season's harvest, and usually this is obtainable only from the higher-class seed-merchants. It is a fact that many small vendors operate very largely with the left-overs of the larger seed-houses. These latter make it their business to restock every season, and often guarantee germination, for the reason that behind their sales stands a valued reputation.

PURITY AND VALUE.

The average seed-sample contains impurities—commercial seeds, weed-seeds, and inert matter. The commercial seeds are those which are known variously as useful seeds or crop seeds. In small percentages they are without significance, as, for example, 1 or 2 per cent. of rye-grass in cocksfoot, or alsike or suckling clover in white clover. When, however, the percentage is above the normal, one of 2 per cent. or less, the value of a line of seed may be considerably reduced. Thus, cocksfoot at 1s. 3d. per pound containing 10 per cent. of rye-grass at 5d. per pound is not good value; nor is white clover at 1s. 6d. containing 5 to 15 per cent. of suckling clover worth only 6d. per pound. Samples of white clover, prices at 1d. and 2d. below the ruling rate, analyse at the Official Seed-testing Station, have shown up to 40 and 50 per cent. of suckling clover.

These may be cases either of ignorance or wilful deception on the part of the seller, but it is well known that such seed is sold in quantity. The weed-seed content of most highly machined seed is small, and such seed need not occasion much anxiety. There are, however, a few exceptions—for example, Californian thistle frequently occurs in high-grade crested dogstail, clover dodder in white clover, and ox-eye daisy in Danish cocksfoot. Low-grade samples of dogstail and white clover are almost certain to contain the impurities mentioned.

SYSTEM IN GERMINATION TEST.

The first operation in the germination test, as carried out at the Official Station, consists of the counting and separating from the sample of two or more lots of 100 seeds of the species named on the sample packet. Thus, if a sample is named as white clover, only pure white clover is taken, no matter how much alsike, suckling clover, or weed-seed may be present. There seems to be a fairly common impression that the lots of 100 seeds may contain anything that the sample contains; but this is not so, the counting of pure seed being strictly adhered to In the case of grass and clover seed mixtures, the Station is frequently asked to put these to germinate *as* mixtures. For a number of reasons, however, this is not practicable, one of the main considerations being that in such mixtures the component seeds are present in different proportions, and are of different sizes and weights; so that several lots of 100 seeds counted in as they come would be extremely unlikely to represent the true proportion of the bulk. Mixtures, therefore, have to be separated into their component parts, and each constituent is tested separately, just as though it were an individual sample.

(N.B.—The foregoing notes are extracts from a recent radio broadcast lecturette.)

EDWIN HALL: PIONEER IN RURAL PROGRESS.

BY the death of Mr. Edwin Hall, of Onehunga, Auckland, on 6th June, rural New Zealand lost one who had given it some forty years of devoted service. He came of English farming stock, and was himself engaged in active farming during earlier years in this country. His main activities, however, were in connection with the Board of Agriculture (from its institution), the Auckland Agricultural and Pastoral Association, the late Council of Agriculture, and the Farmers' Union. Together with the promotion of scientific agriculture, his wide range included such special interests as co-operative organization, agricultural education, and the improvement of rural facilities through telephones and better roads, his knowledge of these subjects being strengthened by investigations abroad. Among Mr. Hall's other public service was membership of the Prisons Board, where his bent found an outlet in the support of prison-farm activities which have proved so successful in this country. His constructive, well-stocked mind, and remarkable prevision at various points of advance in scientific agriculture (notably as regards the mineral content of pastures and top-dressing in relation to animal nutrition) are recalled by those closely associated with him in his life-work. On the personal side a kindly, unassuming disposition endeared him to many friends. A quiet but effective force for progress, the memory of Edwin Hall will be preserved in the annals of New Zealand agriculture.

Wool Research.—Reporting to a recent meeting of the Council of Scientific and Industrial Research, the Acting-Chairman stated : "A considerable amount of wool-fibre measurement, fleece-examination, and other work has been done in connection with determining the alleged faulty qualities of New Zealand wool. The investigations to date have yielded valuable information, but have also revealed the fact that the problem is one of very great complexity. Useful contracts have been made with similar researches in Australia, Great Britain, and Germany, but up to the present no clear-cut line of method of investigation into the problem of wool-improvement has been revealed. It will apparently be necessary to measure, record, and examine a large number of known fleeces in the hope that such characters will emerge as will suggest definite lines of investigations. . . . Suggestions have been received from the Woollen Research Association in Great Britain as to linking up the work with Australia, South Africa, and Great Britain in an Empire scheme."

SEASONAL NOTES.

THE FARM.

PREPARATION OF LAND FOR SPRING-SOWN CEREALS.

SPRING oats and wheat are usually sown in August and early September, and barley in September and very early October, so as to avoid the crop being flooded in the early spring. The nature of the preparatory cultivation for these crops will depend on the class of land and the position they take in a given paddock rotation.

Land after swedes or soft turnips is usually not clear till the end of July or middle of August, so that the seed-bed for spring cereals after roots may be quickly prepared. Cultivation work should be pushed ahead during all good weather, and the oat crop is usually drilled before a start is made on the preparation of the seed-bed for the barley crop. On light land the roller can be used with advantage in consolidating the seed-bed, but on heavy land its use should be avoided, as it causes the soil to settle down and cake. Spring-sown cereals benefit from a rolling after drilling, but unless the land is light the rolling should be delayed till late September or early October, when the land is drier. Rolling hardens the surface, breaks the clods, and lessens the amount of dust at harvest-time. In places of low rainfall cereal crops should not be rolled until the crop is 8 in. to 10 in. high, so that moisture will not be lost by evaporation from the bare, rolled surface.

Oats do better after grass than any other cereal. On light land the ground should be ploughed in July, rolled on the furrow, disked to a fine seed-bed, and harrowed and rolled before drilling. On heavy land the ploughing can often be best done with the digger plough with a skim coulter and knives attached to the tail-plates, which leaves the land in a fit condition for disking.

Spring cereals often follow a winter fallow, and are usually taken in this place when the land was prepared for autumn and winter cereals and the weather prevented sowing at the proper time. Barley often does best when taken in this position in the rotation. If the land has settled down badly in the winter, it should be ploughed and worked down again before the crop is drilled.

Cereals sown in the spring require a heavier seeding than when sown in the autumn, because less tillering takes place than is the case with autumn-sown crops. Also with cereals for threshing, a light seeding in the spring will give rise to a number of late tillers, and consequently a high proportion of shrivelled grain. The average seeding for spring cereals will be about 2½ bushels to the acre, but the amount will vary from 2 to 3 bushels, depending on the cereal and the local conditions of soil and climate.

PASTURE-MANAGEMENT.

All dairying pastures will benefit from thorough chain and tripod harrowing during the winter. Especially so is this the case with pastures on which winter supplementary feeding has been carried out. The organic matter of the spread droppings has a wonderfully

stimulating effect on both clovers and grasses, and frequent chain harrowing is essential for the maintenance of a good even turf. In harrowing old pastures it is not sufficient to spread the droppings only, but the tripods should be heavy enough to slightly tear the surface and allow the aeration of the surface layer of the soil.

Top-dressing with nitrogenous fertilizers to promote winter growth of grass for the early spring is now becoming a practice in dairying districts. The promotion of an early spring growth of grass is most successful where the pastures have been brought to a high state of fertility and production by means of phosphatic dressings—that is, where perennial rye-grass is the dominant grass of the pasture. Most dairying pastures consist mainly of a mixture of rye-grass, cocksfoot, and white clover. The main period of rye-grass growth is from March to December, whereas cocksfoot does not start vigorous growth till the late spring, though it throws a good deal of feed during the autumn. The quick response of pastures to winter dressings with nitrogenous fertilizers, and the amount of feed thrown, depend mainly on the amount of rye-grass present in a pasture.

MANAGEMENT AND FEEDING OF BREEDING-EWES.

Breeding-ewes on fat-lamb-raising farms should receive careful attention during July to ensure that they get sufficient exercise to keep them in a healthy condition. Ewes on turnips should be moved off at night to a bare grass-paddock, and not be put back on the crop until the frost is off the ground. Care should be exercised that the ewes are not hurried or crowded when moving from one field to another.

On or about the 146th day after putting out the rams lambs may be expected, and on North Island fat-lamb-raising farms a few lambs will be dropped during the latter part of July. The raising of early fat lambs necessitates the careful provision of feed for the early spring, and on North Island grass-farms the secret of success lies in systematic top-dressing, careful grazing, and understocking during the winter, so that some of the winter growth of grass may be saved for the spring.

A selection of well-sheltered, clean grass paddocks is very necessary at lambing-time, so that the unlambed ewes can be kept separate from the lambed ones. The ewes should be gone round each morning before breakfast, assistance given to any that require it, and any stray lambs collected and mothered.

—*P. W. Smallfield, B.Ag., Instructor in Agriculture, Auckland.*

THE ORCHARD.

PRUNING OF PIP-FRUITS.

CONTINUING last month's notes on the subject of pruning, it must be remembered that practically the same general principles apply to pip-fruits as to stone-fruits—that is, the building-up of a sturdy tree capable of producing the maximum amount of the best-quality fruit. It is impossible in these notes to give full details of

pruning; only a few of the chief points are mentioned in the hope that they may be of some benefit to those growers not experienced in the art. The Orchard Instructor for the district is available if required, when the many different conditions, according to locality, growth, soil, &c., can be fully discussed.

Apple-trees.

Apple-trees in the orchard may generally speaking be classed under two headings—spur bearers and lateral bearers—and it is this bearing habit that to a large extent decides the method of pruning to be adopted.

Of the spur-bearing type probably the Sturmer is the best known, while the Jonathan is a good example of the lateral-bearing type. Although the Sturmer is known as a spur bearer it does not follow that fruit will not grow on the laterals. As a matter of fact, during the past few years laterals have been cultivated in this class of tree with the best results, and in most districts this practice is to be recommended. It is quite a contrast to the old style of pruning, when the cutting of all side-growths, either back to the base or leaving a stub with one or two buds, was adopted, leaving from six to ten bare poles from which direct fruit-buds were expected to carry the future crops. On the other hand, the cutting of all side-growths in the lateral bearers—Jonathan type—back to the base to produce fruit buds or spurs usually leads to disaster.

Vigorous trees growing on good land will usually produce more laterals than are required for the welfare of the tree; consequently these should be thinned out, selecting the shorter, thinner laterals for fruit-bearing in preference to the heavier and stronger ones. In the majority of cases these laterals should be left intact the first season, allowing them to form fruit-buds during the following season. Should it be necessary to retain some of the heavy and stronger laterals in the tree, these may be cut back to a well-developed bud, probably a third of the length back from the terminal bud, but never stubbing to within two or three buds of the base. During the following season's growth these laterals should develop fruit-buds as well as make growth, either from the terminal bud or from the first and second buds nearest to the cut made. The old practice of cutting back to the fruit-buds the following year is not recommended. Sometimes this is done with the spur-bearing varieties, but much better results will be obtained by treating the growths made from the previous season's cut, reducing them to one, and cutting back three or four buds according to the growth made. This will provide for the development of foliage above the fruit-buds, with the result that better fruit will be obtained. From now on these laterals will produce fruit-buds as well as fruit-spurs, with a short extension of growth from the uppermost leaf-buds. These extensions should be tipped wherever possible to produce a little growth, and for the purpose of pumping up the necessary sap for the production of fruit.

In the case of Delicious it is sometimes found that the continual cutting of the laterals, however slight, will only produce

wood-growth. In such cases it is well to leave the laterals uncut for a season or two until such time as fruit-buds develop on the lateral, when they can be cut according to the growth made, leaving sufficient leaf-buds to carry on the growth. It must be understood that the practice of leaving these laterals uncut indefinitely is not recommended; it is only intended for heavily growing trees, and even then it will be necessary for the pruner to watch his trees, or weak spurs and buds will develop, resulting in poor, undersized fruit. With such a free spur-bearing type of tree as the Sturmer it will be found necessary as the tree matures to prune the spurs and buds, eliminating a good proportion to promote growth and prevent overcropping—serious drawbacks to the Sturmer if not properly attended to.

With the lateral-bearing type of tree it is most essential to prune to keep the tree growing vigorously and to produce new growth every season, without which the crops will gradually diminish. By studying the laterals produced on the Jonathan it will be noticed that the buds near the base are undeveloped and small. Cutting to these buds to produce growth for the following season usually results in the death of the stub. Although in some cases a small lateral may be left uncut for a season to produce fruit from its terminal bud the following season, a good practice when pruning the Jonathan is to cut every twig, the length of cut depending on the growth made, selecting a good healthy bud about one-third to one-half of its length in the case of strong laterals, and not quite as much with the laterals of medium growth. These cut laterals will produce both fruit-buds and new growth the following season. These in turn may be cut and kept growing, as upon these growing laterals the fruitfulness of the tree depends. Should growth slacken off to any appreciable extent, harder cutting must be resorted to for the purpose of renewing vigour. The leaders of the Jonathan type may also be pruned harder than the heavier-growing spur-bearing types, making the cuts to produce growth as strong and upright as possible, thus correcting the spreading habit of this class of tree.

CULTIVATION.

Where no green crops for ploughing under later in the season are being grown, and it is intended to give the orchard two ploughings, the first should be completed as soon as possible. This is preferably done, ploughing away from the trees, leaving the on-ploughing till later in the season. The action of frosts, &c., have a beneficial effect on the soil, not only sweetening it, but making later cultivation much easier.

—*G. Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

The first important work among established citrus-trees at this period is to constantly guard against excess water at the roots. Under-drainage is one of the first essentials, but even where this is thought to be adequate excess water is apt to accumulate during the rainy season. A furrow opened up with the flow from low-lying areas, or a temporary surface ditch opened with a spade for

lesser areas as a means of removing excess and particularly surface-water, will repay for the timely attention. Excess, and particularly stagnant water, even though of temporary duration, is repugnant to citrus-plants.

Harvesting of lemons which attain correct size should be done, and the fruits put away for curing and storage. It is very marked that at this season lemons which are left on the trees to attain ripe condition are most susceptible to citrus brown-rot, and after harvesting readily become infected with blue mould.

Poorman oranges should be given continual attention. This is a crop which is not all available for picking at the same time. The larger-sized and earlier-colouring fruits should be picked, and the smaller sizes allowed to remain, and then picked as they progress in size and maturity. Once the earlier picking has been done it is usual to find very marked improvement in the quality of the remainder. Such extra quality is not attained where the whole crop is left until late in the season.

Where the recommended precautions have been taken to guard against brown-rot little trouble should be experienced, but it will be as well to apply a spray of bordeaux, 4-4-40, during a break of fine weather. Where brown-rot shows up every care should be taken to collect and destroy diseased fruits, rather than allow them to become the source of further infection.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

BREEDING-POINTS.

THE commencement of the hatching and rearing season is now near at hand, and the poultry-keeper should now look well ahead and have everything in perfect order for these operations. Especially where pullets are desired to commence their period of production during next autumn, when the price of eggs is on the up-grade, there must be no delay in getting the breeding-pen mated to ensure that July-hatched chicks will be produced. The best time to hatch-out chicks to lay in winter is during August or early in September, as the early-hatched pullets usually moult during late autumn or early winter. The one great advantage in having some pullets bred to lay during the autumn months is that they come into profit at a time when the adult stock commence to take their period of rest prior to moulting. By early hatching the returns are augmented at a period when, on the average plant, much is going out and little coming in. Especially where the business is being conducted on a more or less large scale the raising of a fair number of July-hatched birds will do much towards increasing profits. It is always a wise course to have the birds mated well before eggs are required for hatching purposes.

In previous notes breeders were advised to select the required hens—the late moulters—for this season's breeding-pens before the moulting process sets in, for it is then, and only then, that the best specimens for breeding can be determined. Usually the long-season layers, and naturally the late moulters, possess a more

desired type and stronger constitutional vigour than the early moulters. Thus it is from among the late moulters that the breeding specimens should be selected. Obviously it would be almost impossible to select such stock now that the whole flock has moulted. Where the timely advice was acted upon, and the late moulters and best breeding types were selected and marked accordingly—say, late in March—the work of mating will now be a simple matter. It is true that owing to developing some weakness odd birds may have to be discarded in the final selection ; but in a general way, and where the work has been carried out by an experienced person, the remaining birds will be the pick of the flock from almost any standpoint.

Those who have neglected to select the late moulters during the autumn will not only find the work of mating a troublesome business, but a high proportion of undesirable stock may also be expected as a consequence. While lateness of moulting can generally be accepted as indicating good producing-power, it is not to be inferred that all late moulters are suitable specimens for the breeding-pen. If a uniform flock is to be built up and maintained something more is required. If this is to be achieved the breeder must have an ideal type fixed in his eye, and keep this always in view, remembering all the time that constitutional vigour must go hand in hand with that type. Health and vigour form the base of all successful breeding operations. The usual signposts to these essential requirements are a clean face, clear bright prominent eyes, short shanks set wide apart, alert carriage, and tight thick feathering.

The question of size is another important matter. Small undersized specimens of their breed should be rejected however well they have laid. Such stock usually produce weedy progeny which yield only second-grade eggs, which are next to useless for the export trade. The production of small eggs is probably one of the greatest weaknesses in connection with present-day poultry-keeping. The size of eggs can be increased only by careful breeding, and by the selection for breeding of only those birds which lay good-sized eggs. Of course, on most plants there will be found more or less variation in type among the individual birds. This being so, an endeavour should be made to classify the hens, and to mate with them a male strong in points where the females are weak, or *vice versa*. For example, where hens show a tendency to be on the small side, weak in front, and loose feathered, or carrying an excessive comb, &c., a male should be selected strong in these points.

In a general way, the qualifications to be looked for in a good breeding male, as indicating constitutional vigour and breeding-power, are good chest-development, width across the back, tight feathering, and an alert bold carriage. While feminine characters should be looked for in the female, the male should be practically at the other extreme. The head should be masculine in every respect, but without coarseness. In addition, he should be the progeny of a heavy-laying hen producing good-sized eggs. Where old cocks are used for mating, about three parts of the spurs should be removed. A fine saw will serve for the purpose, as practically no bleeding will take place if a little Stockholm tar is

applied to the cut part. Long sharp spurs are not only a common cause of infertile eggs being produced, but of hens' sides being badly ripped as well. To ensure a high percentage of fertile eggs containing strong germs it is of the first importance that the male be maintained in the best of health and vigour. It is a good plan to frequently handle the breeding males, and when a bird is found to be out of condition he should be removed and given a good dusting with insect-powder and replaced by another. When it is found necessary to remove a male from the breeding-pen it is a mistake to keep him confined in a coop by himself, as he is apt to fret and cease to thrive. He will do much better if given the company of one or two hens, preferably birds that are not laying.

PRODUCTION AND EXPORT.

According to returns compiled by the Government Statistician, there was on 31st March last 835,097 lb. of egg-pulp cold-stored in the Dominion for use by large consumers during the scarce season, as compared with 591,781 lb. on the corresponding date of last year. On 31st July last, or what might be termed the beginning of the flush and cheap season, a carry-over of 83,049 lb. was recorded, indicating that 508,732 lb. was used between 1st April and 31st July, 1927. Thus, if a similar quantity is used during the four corresponding months of this year, there will be a carry-over of 326,365 lb. at the end of July next. If this amount is added to the extent of some 182,000 lb. there should be approximately sufficient pulp for the current winter season, while obviously there will be a greatly increased number of eggs available for the retail trade.

The foregoing analysis, and the almost safe assumption that there is a decidedly increased number of fowls in the Dominion as compared with last year, goes to indicate that in all probability there will be a surplus of eggs beyond the requirements for the local trade during the coming spring. Should such be the case, there is every reason to believe that the price of eggs will fall below a paying price for the producer (in view of the present high cost of production in the way of foodstuffs) unless advantage is taken of the overseas trade which is offering. The shipping of eggs from New Zealand to the London market has now passed the experimental stage. It has been proved beyond doubt that our eggs can hold their own against those of other competing countries when nothing but good-sized and good-quality produce is shipped. If eggs are to be exported during the coming spring, when they will return the best possible paying values, there must be no such thing as "near enough" in regard to quality. No egg should be packed unless weighing 2 oz., and perfect in all other respects, including clean shells. Not only this, but the overhead charges as compared with those obtaining hitherto must be reduced.

If such necessary reforms are to be brought about, and the export trade placed on a sound footing, early organization and joint action on the part of producers is imperative. The sooner producers realize that they cannot afford to be disunited when it comes to exportation the better will it be for their own pockets and the industry as a whole.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

THE DORMANT SEASON.

DURING the months of June and July activities in the apiary, so far as the bees are concerned, should cease. No advantage is to be gained by interfering with the bees, providing the colonies have been left with ample stores, queen right, and well supplied with mats to conserve the heat of the cluster. After heavy rains it is advisable to remove the roofs to ascertain the condition of the mats, and if any are found to be damp they should be removed. This can be done without disturbing the bees. Damp mats should not be tolerated, as they are harmful to the health of the bees at all seasons of the year, and more particularly during the winter months when dormant colony conditions obtain. As advised previously, a plentiful supply of mats should always be on hand.

MOVING OF BEES.

Providing sufficient care is taken, bees may be moved long distances with perfect safety at this season. It is not advisable to delay this work until the spring, as brood-rearing will then have commenced in earnest, and the numerical strength of the adult bees will be greater than at this period. Moreover, there is little brood in the hives to be injured. When moving bees short distances—say, up to a couple of miles—little preparation is necessary beyond screening the entrance with wire gauze, and fastening the bottom-boards and roofs with crate staples or battens. It is well to choose a cold night before closing the entrances of the hives to be removed. On arrival at the new location the bees should be allowed to settle down prior to removing the gauze. It is quite a good plan to place some obstruction—a piece of board will suffice—in front of the entrance, as this will cause the bees to investigate and take new bearings. Some such action is necessary to prevent the field-bees from returning to the old location.

When removing bees long distances, which may necessitate their confinement to the hives for a lengthy period, it is essential that they be well packed so as to allow of ample ventilation. To safeguard against suffocation of the bees the hives require to have wire screens top and bottom. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions of a hive-body, and covering this with wire cloth. When placing the screens on the hives proceed as follows:—

The evening before removal, after the bees are all in, place a frame alongside each hive level-side up. Gently lift the hive on to the frame. Next remove the cover and mat, and place the upper frame level-side downward in position. The bees being now secure, the battens to hold the frames can be nailed on the following morning. Place a hive-cover over the frames in the event of rain falling during the night. When railing bees, the frames should run parallel with the truck, but with road transport the reverse should be the case. This rule should be followed to prevent the frames from rocking and thus killing the bees.

It is well to remember that (as a precaution against the spread of disease) bees cannot be removed a distance of more than 10 chains

without the written consent of an Inspector. Failure to obtain the necessary consent renders a person liable to a fine not exceeding £25.

THE WINTER OVERHAUL.

During the winter months, as opportunity offers, the working-plant of the apiary should be carefully overhauled. The engine, extractor, and tools require to be examined, and defective or broken parts replaced, so as to have all in readiness for next season's work. It is not wise to leave the repairing and painting of spare roofs, hives, and bottom-boards until they are required to be brought into use. Now is the best time to lay down future plans; and if an increase in the number of colonies kept is decided upon, or the establishment of an out-apiary is being considered with the object of increasing income, no time should be lost in getting together the required number of extra hives, supers, roofs, and bottom-boards, also in the preparation of frames and the fitting of comb-foundation.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

EARLY SPRING WORK.

WITH the month of July the halt between the growing-season ends, and some growth is made by the hardier plants on the lighter lands in the warmer localities. It is for those engaged in horticulture to start sowing and planting as early as the preparation of the land and the season permits, in order to spread, as far as possible, the glut of work that comes round with every spring. There is also the natural desire to make full use of the growing-period—an economy which is sometimes neglected. In the case of light lands that are inclined to be over-drained an early start with the planting-season is of special urgency. On colder and heavier soils it is a time to expedite the preparation of the land for the earlier crops, remembering that good and timely preparation solves most of our problems. It is a time to plough-in green crops for manure, or such of the slower-acting manures as bonedust or organic manures from the stock-yards. These are slow and lasting in their action and effect, and are usually turned in deeper than the more soluble dressings applied shortly before planting and sowing.

As soon as the land is in condition, plant out main-crop cabbage and cauliflower, and lettuce and autumn-sown onions from the plant-beds; also shallots, garlic, and artichokes. In some localities early potatoes may be planted now. Of the more important crops that may be sown early are cabbage and cauliflower for summer use, lettuce, spinach, early peas, and broad beans.

The winter crop of vegetables planted last summer gave poor results in localities that suffered from dry weather at that period; elsewhere good crops were obtained. Savoys, leeks, and celery will now be nearly finished, and the broccoli planted then will soon be maturing. Clean up this land as soon as it is available; it is probably in rich condition, and very suitable for shallow-rooting

crops such as lettuce, onions, peas, &c. The celery crop suffered—rather badly in some places—from "late blight" (*Septoria Petroselini*). Where this occurred all waste should be burnt to prevent soil-infection. This trouble may originate from the soil or the seeds, and demands close attention.

The spring cabbage and cauliflower crops planted in late autumn will be making increased growth; also the plantings of rhubarb and asparagus. These should now be assisted by suitable hoeing and cultivation, with occasional dressings of fertilizers.

Seedling tomato-plants will soon be ready for pricking out into boxes. If the condition of the soil is doubtful and means for sterilization are not available, water the soil in the boxes with boiling water the day before pricking out the plants. Carefully avoid high temperatures in the houses and frames, and have a few heaters handy to combat late cold snaps that occasionally occur in some districts. Complete the preparation of the soil in the glass-houses which are later to be planted out in tomatoes. This should be completed in good time to allow it to settle and firm before planting.

Brakes of bush-fruits should be sprayed before they start into growth; a good 8–6–40 bordeaux will be most generally useful. Make an application of fertilizers where necessary. At this season avoid deep cultivation among fibrous-rooted plants of this class, as it is apt to check the growth and cause serious debility in most instances.

SMALL TRIAL AREAS OF TOBACCO.

Those who purpose to grow a small trial area of tobacco this season should carefully consider each operation, particularly that of sowing. This plant is classified as a half-hardy annual—that is, its susceptibility to frost is about equal to that of the tomato, potato, and other plants of that class. For this reason it is not until the month of October or early in November that it can be planted out in the open without undue risk. This planting-out period must be decided after considering all the circumstances. It is desirable to make the decision as early as possible, and that will depend on locality, climate, and available shelter. An approximate planting-period being decided, the operation of sowing the seed is to be considered. The period necessary for growing plants for the field will be from two to three months, according to the climate and the skill of the operator. For experimental purposes it is as well not to press the point of early planting, but the aim generally should be to be ready to put out the plants during the first fortnight of November. To do that the seed should be sown during August, and it is time now to make the necessary preparation. In some cases it is the custom to have the seeds germinated in boxes under glass by a nurseryman, and delivered to growers early in the month of September in a suitable hardened condition for pricking-out into sheltered beds. In many cases this will be the best plan to adopt; the grower then has only to prepare the beds in readiness for the seedlings. Naturally, the site for these should be well drained and sheltered, and the soil friable and of good quality.

Commercial beds are made about 6 ft. wide and as long as necessary. The soil is sometimes steamed or burnt at this season

to destroy weeds and pests that may interfere with the diminutive seedlings. For pricking-out a small number of plants for experimental purposes a piece of land in good heart in the house-garden will probably meet the case. For purposes of protection, the bed should be boxed by surrounding it with a board on edge projecting 6 in. above the ground, and on which cheese-cloth may be stretched to protect the young plants.

The advantage of sowing the seeds in boxes or pans first is that they can be given the shelter of a glasshouse or frame. If this is done on the farm, shallow-tray boxes should be used and filled with good sweet friable soil. A useful measure of sterilization may given here by watering the boxes with boiling water. The following day the seed may be sown thinly and pressed into the soil. A very light dusting of sifted sand may be added, although it is hardly necessary. Cover the boxes with glass and a sheet of paper to retain moisture and afford shade, and place them in a moderately warm house or frame. As soon as the seeds germinate, gradually remove the covering, and give them light and air. They will be ready for pricking out when the first rough leaves develop.

TOOLS AND IMPLEMENTS.

Good results depend not only on a right judgment in planning, but to a very great extent also on well-timed skilful execution. The ease and skill with which operations are carried out depend very much on the class and condition of the tools used. Experienced workmen realize this, and they are very quick to carefully consider new samples or suggestions regarding the tools and implements of their craft. The most desirable features are, first, that of being able to lay one's hand on an implement without hunting for it, and, second, to find it in a serviceable condition.

Most of us will find under this heading that decided economies may be made, while the work is more easily performed and the pleasure of skilful achievement takes the place of what may easily become slow, uninteresting drudgery. This applies just as much to horse-drawn implements as those used by hand, although in the latter instance the disability may be more easily realized.

The wooden shaft of most hand implements when new is in a more or less natural state, except for the shaping. If the handle is rubbed down with sandpaper for a few moments and then dressed with boiled linseed-oil the difference will be much appreciated by the user, who will find the easier manipulation a great assistance. One or two more applications of oil, and natural use will give the shaft a high polish of the best kind.

Most edged tools when bought are unground, with merely more or less indication of the bevel to be given. Before use they have to be ground on a grindstone, and finished on a whetstone, if a sharp cutting-edge is required. A budding-knife, secateurs, scythe, spade, hoe, shears, or lawn-mower vary very much in the quality of the steel and the width and angle of the bevelled cutting-edge. These demand careful study if the implement is to make work pleasant and profitable by means of rapid and skilful execution. The slow labour of the grindstone is often replaced nowadays with the hard steel rasp that

cuts the shoulder off an edge and forms a bevel on a new implement very rapidly. This instrument should be used with careful restraint: so effective is it that the steel is actually whittled away with careless use. For a fine knife-edge carborundum stones are required to finish the job.

One often sees implements left out in the ground overnight, or sometimes even after a job is finished until they are required again. Under such circumstances the condition of the implement is very rapidly destroyed, and after a very short period of this treatment it is almost impossible for it to be replaced. Moisture, acidity, and decay destroy the surface of the wood and iron, even after merely a comparatively short exposure. It is sometimes necessary to leave large implements out overnight, but they should be well painted, covered with a waterproof cover, or, as in the case of a plough, left in such a way as to suffer as little as possible from the exposure. A plough, for instance, is best left on the headland with the point of the share on the surface in a position to go straight ahead when work is recommenced. If the mouldboard and share are half-buried in the soil, the surface of the metal becomes pitted and rough, especially if owing to bad weather it has to remain there a few days. If it is left on the surface and rubbed clean it will suffer least and quickly repolish after a little use. Hoes, spades, and suchlike implements should always be rubbed or washed clean after use, and stood in a rack under cover; with occasional sharpening they will then be always at hand and in serviceable trim. Such sharp-edged tools as budding, grafting, and pruning knives are best cleaned, sharpened, and greased after use and put away in a drawer.

Such practices as these enable the workman to ignore the tools while using them, and give the whole of his attention to the operation being carried out. So important are these facts regarded by practical men of experience that it is commonly considered a true judgment of a man's ability may be arrived at by an inspection of the tool-shed.

—*W. C. Hyde, Horticulturist, Wellington.*

MILKING SHORTHORNS AT RUAKURA STATE FARM.

The stud bull Pukerimu Premier and some of the two-year-old heifers.

IMPORTATION OF FERTILIZERS, 1927-28.

Chemistry Section.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1928, have been prepared as usual from figures specially supplied by the Comptroller of Customs, and are presented in the accompanying tables, together with comparative data for preceding periods.

TABLE 1.—SUMMARY OF FERTILIZER IMPORTATIONS, 1927-28 AND 1926-27.

Fertilizer.	Quantity.		Declared Value.	
	Year 1927-28.	Year 1926-27.	Year 1927-28.	Year 1926-27.
	Tons.	Tons.	£	£
Bonedust	725	4,805	6,229	15,932
Bone-char	201	..	662	..
Basic slag	48,913	53,327	133,400	185,139
Superphosphate	6,616	15	18,304	89
Nauru and Ocean Islands phosphate	89,169	125,709	113,459	165,803
Island phosphate (other)* ..	54,204	35,832	80,236	56,868
Egyptian phosphate	6,603	5,979	19,974	18,730
American rock phosphate ..	..	21,977	..	32,485
Nitrogenous guano	18,947	..	27,413	..
Phosphate (other)	20,030	..	39,216	..
Kainit	786	2,195	2,164	6,295
Muriate of potash	23	..	198	..
Sulphate of potash	1,502	2,016	14,809	19,740
Potash (other)	4,267	6,474	18,913	27,565
Sulphate of ammonia	1,077	957	16,239	12,862
Nitrate of soda	1,021	1,466	11,699	17,057
Sulphate of iron	131	61	1,332	658
Fertilizers unspecified	84	57	1,344	640
	254,299	257,870	505,591	559,863

* For details see Table 3.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1918-28.

Year ended 31st March,	Bonedust.	Basic Slag.	Superphosphate.	Pacific and Indian Oceans Phosphates.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons.	Tons.
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	,,
1924	4,158	39,632	255	76,517	5,996
1925	2,452	45,682	10	108,163	8,530
1926	2,085	44,314	500	97,488	10,037
1927	1,805	53,327	15	161,541	5,979
1928	725	48,913	6,616	113,373	6,603

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR 1927–28, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.		Chile.	India.	Morocco.	Netherlands.	Pacific and Indian Oceans Islands		United Kingdom.	Belgium.		France.		Germany.		Egypt.
	Sulphate of Ammonia.	Bonedust.	Nitrate of Soda.	Bonedust.	Phosphate.	Superphosphate.	Name of Island.	Phosphate.	Basic Slag.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Phosphate.
Auckland ..	372	25	1,000	680	4,206	..	New Caledonia	4,480	4,915	18,280	65	1,185	1,255	4,595	1,084	..
							Nauru ..	32,667								
							Ocean ..	34,115								
							Makatea ..	12,180								
							Seychelles ..	1,797								
New Plymouth ..	50	..	..	..	3,322	..	Nauru ..	15,459	3,436	8,025	1	750	395	350	273	..
Patea ..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..
Wanganui ..	65	..	..	..	3,050	..	New Caledonia	1,840	..	..	..	..	..	..	..	..
							Nauru ..	16,861								
Napier ..	..	..	..	..	..	..	..	..	..	..	20	..	15	..	13	..
Wellington ..	97	..	..	20	..	..	..	..	2,779	2,534	30	68	353	226	139	2,603
Nelson ..	5	..	..	..	..	..	..	..	..	75	..	..	80	..	53	..
Westport ..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..
Lyttelton ..	220	..	20	..	2,811	..	Walpole ..	1,700	50	5	..	25	248	..	170	1,000
							Ocean ..	5,800								
							Nauru ..	13,727								
							Makatea ..	2,097								
Timaru ..	..	..	1	..	..	..	..	..	..	30	..	..	35	..	60	..
Dunedin ..	108	..	..	..	..	..	Ocean ..	1,840	225	305	25	..	340	50	265	..
							Seychelles ..	1,620								
							Nauru ..	7,403								
Invercargill ..	86	..	..	..	..	6,536	Seychelles ..	5,870	25	955	..	..	1,041	..	608	3,000
							Walpole ..	1,605								
							Nauru ..	1,212								

WEATHER RECORDS: MAY, 1928.

Dominion Meteorological Office.

GENERAL SUMMARY.

The month of May was on the whole a wet and rather stormy one. The season is still (early in June) characterized by a relative absence of westerly winds. When strong winds have blown, they have frequently been along the length of the Islands, so that many parts, notably the Cook Strait region, have escaped their severity. They were felt mainly in the northern parts of the Auckland Province, the Foveaux Strait region, and the surrounding ocean waters. Rainfall was above the average over almost the whole of the North Island. In the South Island more varied conditions prevailed, most of the western districts having more, and most of the eastern districts less, than the average.

Temperatures remained rather mild, scarcely any frost being experienced over the greater part of the North Island. In the South Island, however, winter weather was experienced after the first week, and frosts were fairly frequent. These were compensated for by many bright and sunny days.

The month opened with an intense anticyclone centred to the west of Westport. The weather was stormy, with gales in many places. Very heavy rain was recorded in the central provinces.

Unsettled conditions continued over the whole of the first week. Westerly gales due to depressions of a westerly type blew on the 4th and 5th. On the 6th a cyclone appeared to the south of Norfolk Island, and subsequently developed two centres, one of which passed through Cook Strait and the other north of Cape Maria Van Diemen. This was an active disturbance. Strong northerly gales were experienced during its approach, and south-westerlies after its passage. It was followed also by a decided fall of temperature, which practically marked the commencement of winter for the South Island. Frosts were frequent in Canterbury and Otago from then onwards, and the mountain-tops were covered with snow. Another vigorous cyclone crossed the South Island on the 14th, and brought heavy rain, especially to the North Island. High floods caused damage in Kaitaia and the surrounding districts. A fourth cyclone crossed the North Island on the 18th, and was followed by southerly gales, which covered an extensive area over and on all sides of the Dominion. Seas were rough for several days in the surrounding ocean waters.

During the passage of an anticyclone over the southern portion of the Dominion on the 24th and 25th, barometers rose as high as 30·7 in. The only other anticyclone of any intensity was one which covered New Zealand on the 10th.

The tendency for disturbances to assume the cyclonic form was maintained until the end of the month. Further examples of this type of storm controlled our weather on the 26th and the 29th.

RAINFALL FOR MAY, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average May Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	8·00	17	3·20	5·06
2	Russell	9·01	14	3·58	5·92
3	Whangarei	11·73	21	4·44	7·84
4	Auckland	10·42	30	3·10	4·50
5	Hamilton	9·23	23	2·10	4·54
6	Kawhia	7·61	24	1·44	5·57
7	New Plymouth	7·09	22	1·14	6·23
8	Riversdale, Inglewood ..	9·64	19	1·04	9·82
9	Whangamomona	10·93	14	1·63	7·05
10	Eltham	5·44	17	1·10	5·27
11	Tairua	13·22	17	4·54	7·64

RAINFALL FOR MAY, 1928—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
	North Island continued.				
		Inches.		Inches.	Inches.
12	Tauranga	9·59	19	3·42	5·16
13	Maraehako Station, Opotiki	8·78	15	2·50	5·70
14	Gisborne..	5·40	12	1·97	5·67
15	Taupo	8·39	15	2·19	4·09
16	Napier	6·66	19	1·27	3·74
17	Maraekakaho Stn., Hastings	5·45	16	1·57	3·52
18	Taihape	3·78	18	0·58	3·84
19	Masterton	4·81	19	0·84	4·03
20	Patea	6·02	21	1·07	4·34
21	Wanganui	4·51	17	0·80	3·42
22	Foxton	8·06	16	2·16	2·78
23	Wellington (Karori Reservoir)	4·95	16	0·92	4·40
	South Island.				
24	Westport	9·32	22	1·92	6·58
25	Greymouth	8·69	19	1·65	8·01
26	Hokitika	10·97	19	2·37	9·71
27	Ross	13·09	14	3·38	9·73
28	Arthur's Pass	15·99	16	3·65	11·02
29	Okuru, Westland	7·32	7	2·50	11·60
30	Collingwood	7·94	17	1·69	10·18
31	Nelson	4·12	13	1·01	3·08
32	Spring Creek, Blenheim ..	2·98	13	0·75	3·19
33	Tophouse	7·56	14	2·25	5·94
34	Hanmer Springs	4·18	13	1·11	4·51
35	Highfield, Waiau	2·42	7	0·70	3·41
36	Gore Bay	3·66	12	0·96	3·83
37	Christchurch	2·29	11	0·83	2·65
38	Timaru	2·06	11	0·96	1·41
39	Lambrook Station, Fairlie ..	2·08	9	1·16	1·53
40	Benmore Station, Clearburn	1·54	12	0·58	1·97
41	Oamaru	1·42	11	0·40	1·61
42	Queenstown	1·87	9	0·50	2·63
43	Clyde	0·69	8	0·16	0·97
44	Dunedin..	1·33	11	0·35	3·23
45	Wendon	1·22	8	0·33	2·23
46	Gore	1·65	14	0·35	2·71
47	Invercargill	3·54	16	0·64	4·46
48	Puysegur Point	10·04	24	1·32	6·81
49	Half-moon Bay, Stewart Is.	5·31	22	1·14	4·50

FERTILIZER IMPORTATIONS: MARCH QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the three months ended 31st March, 1928 :—

Sulphate of Ammonia.—Australia, 262 tons; United States of America, 50 tons. *Basic Slag.*—United Kingdom, 6,266 tons; Belgium, 18,422 tons; France, 2,000 tons; Germany, 5,221 tons. *Guano.*—United Kingdom, 10 tons; New Caledonia, 4,418 tons. *Rock Phosphate.*—Nauru and Ocean Islands, 9,059 tons; Makatea Island, 1,909 tons. *Phosphates (other).*—Belgium, 4 tons; Morocco, 13,389 tons. *Kainit.*—Belgium, 10 tons; France, 257 tons; Germany, 36 tons. *Muriate of Potash.*—France, 5 tons. *Sulphate of Potash.*—Belgium, 15 tons; France, 251 tons; Germany, 185 tons. *Potash (other).*—Belgium, 56 tons; France, 728 tons; Germany, 467 tons. *Sulphate of Iron.*—United Kingdom, 3 tons; Australia, 51 tons. *Other Manures.*—Germany, 53 tons.

BOYS' AND GIRLS' AGRICULTURAL CLUB COMPETITIONS.

DOMINION CHALLENGE SHIELD.

RECOGNIZING the great educative value of boys' and girls' agricultural clubs, Messrs. Henry A. Lane and Co., of London, through their Hawera representative, Mr. G. A. Buckeridge, have presented to the Department of Agriculture a handsome challenge shield for competition among the schools taking part in the movement. The shield is to be won and held for the year by the school gaining the most points in the various competitions, such as calf-rearing, root-growing, or any other that the executives of the clubs may introduce; also points won at shows by exhibits entered in special classes confined to club competitors.

Schools taking part should keep a careful record of all prizes won by them, including, where possible, a newspaper report of the competition. These records should be forwarded to the Instructor of the Department of Agriculture for the district at the end of July in each year. The Instructor, after checking, will forward a report to his head office, where the award will be made. The Department will present each winning school with a photograph of the shield as a suitable record.

Points for the various competitions are as follows:—

(1) At the actual competitions—
 Championships, 1st, 2nd, 3rd; points, 3, 2, 1.
 Groups, 1st, 2nd, 3rd; points, 3, 2, 1.
(2) At agricultural and pastoral shows—
 Championships, 1st, 2nd, 3rd; points, 3, 2, 1.
 Classes, 1st, 2nd, 3rd; points, 3, 2, 1.
(3) At winter shows—
 Championships, 1st, 2nd, 3rd; points, 3, 2, 1.
 Groups, 1st, 2nd, 3rd; points, 3, 2, 1.
 Classes, 1st, 2nd, 3rd; points, 3, 2, 1.

Points for the percentage of children that are eligible in each school actually taking part in the competition are to be awarded, but no percentage points will be allowed for competitors at the agricultural and pastoral and winter shows. The points for eligible competitors are computed as follows: For 20 per cent. of eligibles, ½ point; for 30 per cent., 1 point; and so on, increasing by ½ point for each additional 10 per cent. up to 10 points maximum for 100 per cent. of eligible competitors.

WHEAT AND OATS THRESHINGS.

TABULATED below are returns of actual threshings received by the Census and Statistics Office up to 10th May from threshing-mill owners, and covering the months of January to April, 1928, inclusive:—

Land District.	Wheat.		Oats.	
	Quantity threshed.	Average Yield per Acre.	Quantity threshed.	Average Yield per Acre.
	Bushels.	Bushels.	Bushels.	Bushels.
North Auckland	806	15·50	..	..
Auckland	311	18·29	..	..
Gisborne	1,947	26·31	304	30·40
Hawke's Bay	10,884	33·39	13,155	34·89
Taranaki	2,696	50·87	230	38·33
Wellington	72,124	34·90	40,302	41·42
Nelson	28,711	28·97	9,596	30·56
Marlborough	88,212	30·10	35,093	31·28
Canterbury	5,357,178	40·15	1,715,627	44·77
Otago	723,246	35·22	560,170	48·84
Southland	114,134	34·93	580,034	47·57
Totals ..	6,400,249	39·08	2,954,511	45·61

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SOWS NOT COMING IN SEASON.

"DAIRY-FARMER," Bulls :—

I should be grateful for any information you could give me regarding sows not coming in season. I have two sows (not maidens) which have been running with the boar for about two months. They are in fair store condition, have a good run, plenty of shelter, and are fed with skim-milk, lucerne, and carrots. The boar has proved himself right by effectively serving a neighbour's sows. This in not the first time my sows have failed to come in season, as I have known them to go for months after their last litter before coming on again.

The Live-stock Division :—

As the sows have not appeared in season for two months, the trouble would seem to be due to a lack of concentrates in the feed ration. It is recommended that you separate the sows from the boar, and feed the sows some concentrate such as linseed-meal and bran, in addition to what they are at present receiving. The bran and meal may be used in equal parts, allowing about 3 lb. of the mixture per head per day. Crushed beans or peas may be used instead of linseed if more convenient. The addition of some mineral such as iodine may be made with advantage as follows: Dissolve 1 oz. of potassium iodide in 1 gallon of water, and mix in the feed one tablespoonful of this solution once a day for each sow.

ELIMINATION OF RUSHES IN GRASSLAND.

"SETTLER," Gisborne :—

Please advise the remedy for rushes persistently coming up on reclaimed swamp-land. In spite of repeated cuttings (or, rather, digging out) the common rush continues to give trouble, although the ground is very well drained. I am told the ground is sour and in need of top-dressing. The grass thereon—clover, rye, and crested dogstail—flourishes, and is well kept down by stock.

The Fields Division :—

Change of soil and pasture conditions in sufficient degree is essential for the suppression of rushes. Draining the land and the subsequent removal of the plants by digging are important factors in their suppression; other agents that also contribute considerably to the elimination of the plant on grassland include applications of sufficient lime, appropriate manuring, and satisfactory stocking. You are recommended to make an application of lime at the rate of 1 ton per acre and also a dressing of 3 cwt. of basic super per acre, either at the present season or during early spring. This will improve both soil-conditions and pasture. The pasture should then be judiciously stocked; it is advisable that the sward be depastured on a system of rotational, in contrast to close and continuous, grazing. This means periodical closing of the area until the pasture attains a reasonable degree of growth and afterwards heavily stocking to ensure as far as possible the uniform eating-down of the herbage.

TROUBLE WITH CASTRATION WOUND IN HORSE.

E. TOLME, Aria :—

I have a gelding rising three years old which was castrated at the end of March, but so far the wound has not quite healed up, and there is a raw-looking piece of tissue hanging down from one of the incisions which was made when he was being operated upon. The piece hanging down is about as thick and half as long as an ordinary man's forefinger. It appears to me to be the end of the testicle-string covered with proud flesh. Will you kindly advise me how to treat the case?

The Live-stock Division :—

The piece of tissue protruding from the castration wound may only be a piece of omentum, and, if so, is quite easily removed. On the other hand, if as you suggest it is testicle string or cord, then more care will have to be exercised. If only omentum it will be fairly soft, and you will be able to pull it out a little and cut it off with a red-hot iron—the same kind of iron as is used for line-firing horses' legs. After it is seared through it will slip back out of sight and you will have no further trouble. If it is the cord that is diseased then the animal would require to be properly dealt with by a qualified veterinary surgeon, or one accustomed to castration who knows how to deal with such eventualities. In this case the animal would have to be cast and chloroformed, and after a clamp had been put on high up, the end of the diseased cord would be taken off either by the hot iron or by any other surgical means. Another treatment (which could not be altogether recommended) would be to slip over the protruding tissue a piece of strong whipcord in the form of a clove hitch, and pull up tight, leaving the two ends of the string long enough to be tightened every second day until the protruding piece of tissue dropped off. If following this treatment, give all round the part a good painting with iodine before and after operating, and frequently clean it up with antiseptic solution.

PLANTING LOMBARDY POPLAR CUTTINGS.

C. D. SUTTON, Te Horo :—

Please advise the best time and method for planting Lombardy poplar cuttings. I thought of putting in cuttings about the thickness of one's arm.

The Horticulture Division :—

The present time is very suitable for planting cuttings of the Lombardy poplar. Large cuttings such as you describe would very possibly grow, but it is customary to make them of wood about ⅜ in. in diameter and about 9 in. long, inserting two-thirds of the length in the ground. Such a cutting will make a better tree in every way.

HEIFER WITH LUMPY JAW.

A. H. J., Pokeno :—

A heifer of mine (now rising two years) developed a large swelling under her lower jaw last season. This afterwards went down, but developed again this season, and has now moved round to the right side of the jaw, and appears as a bad attack of mumps. The animal has always been in good condition and health otherwise, and does not appear to be affected in any way by the swelling. I would appreciate any information regarding this trouble.

The Live-stock Division :—

The swelling is almost certainly the condition known as "lumpy jaw." This is the common name for the disease technically known as actinomycosis, and is caused by a particular kind of fungus finding its way into the animal's system, usually through wounds in the mouth. The wounds caused by the shedding of the teeth are believed to be a fruitful starting-point for this disease, and thus the affection is usually seen in young cattle. Another phase of this disease is seen in the condition known as "wooden tongue." In this affection the tongue swells up, causing profuse salivation and great difficulty in swallowing. When the tongue only is affected recovery can be expected in the majority of cases if taken in hand early; but where the jaw is affected treatment may not be nearly so successful. If the swelling is hard, and is found on manipulation to be firmly adherent to the jaw, treatment is hardly recommended, except in the case of a very valuable animal. The treatment found so successful in wooden tongue is to drench the beast with a solution of potassium iodide in a pint of warm water twice daily. The dose of potassium iodide for each drench is 2 drams for an ordinary cow. For a small heifer the dose should be less—say, 1 dram—according to age and size. This treatment should be continued for a week, but may have to be carried on for another similar period, according to results. If the animal seems off colour the treatment must be stopped after four or five days. Actinomycosis is a contagious disease scheduled under the Stock Act, so should be reported to a Stock Inspector.

STRAINING FENCING-WIRE.

"JINNY," Hatuma :—

Is it necessary when straining fencing-wire to stretch the wire—that is, go along the fence and pull sideways on the wire?

The Fields Division :—

It is advisable to stretch the wire in the way you suggest, or in some similar way, in order to avoid the necessity which will arise if this is not done of straining the wire almost immediately again.

STOCK SLAUGHTERED, 1927-28.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1928 :—

Stock.	Abattoirs.	Meat-export Slaughterhouses.	B con-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	160,781	220,831	..	81,027	462,639
Calves ..	41,272	120,015	..	2,093	163,380
Sheep ..	641,907	2,300,069	..	238,298	3,180,274
Lambs ..	130,905	5,776,321	..	25,194	5,932,420
Swine ..	121,763	259,114	49,686	24,834	455,397

FORTHCOMING WINTER SHOWS.

South Taranaki Winter Show Company: Hawera, 27th June to 4th July.
Auckland Winter Show Association: Auckland, 11th to 21st July.
Canterbury A. and P. Association: Christchurch, 11th to 25th August.
Wellington Winter Show Association: Wellington, August (dates not yet fixed).

PUBLICATIONS RECEIVED.

MONOGRAPH ON THE NEW ZEALAND BEECH FORESTS: Part II. The Forests from the Practical and Economic Standpoints. By L. Cockayne, F.R.S., Ph.D., F.N.Z.Inst. New Zealand State Forest Service, Wellington. Price 2s. 6d.

CLASSING THE CLIP: A HANDBOOK ON WOOL-CLASSING. By E. C. Cowley, Lecturer in Charge, Sheep and Wool Department, Technical College, Sydney, N.S.W. Angus and Robertson, Ltd., 87 Castlereagh Street, Sydney. Price 15s.

THE REPRESENTATION AND ORGANIZATION OF AGRICULTURAL WORKERS. International Labour Office, Geneva. Price 3s. (British publisher, P. S. King and Son, Ltd., 14 Great Smith Street, London S.W. 1.)

IODINE FOR LIVE-STOCK. By F. E. Corrie, B.Sc., N.D.A., N.D.D. De Gruchy and Co., Ltd., 45 Mitchell Street, London E.C. 1. (Gratis on application to publishers.)

YOUR TRACTOR: ITS CARE AND MANAGEMENT. British Imperial Oil Co., Ltd., New Zealand.

Noxious Weeds Order.—The Rangitikei County Council has declared hemlock (*Conium maculatum*) and tutsan (*Hypericum Androsæmum*) to be noxious weeds within that county, the special order taking effect on 1st June.

New Zealand Department of Agriculture.

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The New Zealand

Journal of Agriculture.

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FUNDAMENTAL GRASSLAND RESEARCH.

SCHEME OF EXPERIMENTATION INITIATED BY DEPARTMENT OF AGRICULTURE.

E. BRUCE LEVY, Agrostologist, Plant Research Station, Palmerston North.

GRASSLAND research work up to the present has led to the conclusion that the constitution of the sward is governed almost entirely by the environmental conditions under which the pasture plants are asked to grow, and that the successful grassing of any country is a question of either (1) choosing species attuned to conditions as they exist or come to exist on any one soil-type, or (2) modifying conditions by draining, liming, manuring, harrowing, &c., so that the higher-production species may thrive.

We may start, then, with the conception that each grass and each clover has a standard set of conditions which must be provided before that species will persist and thrive. Each species is an indicator of the environmental conditions ruling, and when undesirable change in the composition of our pastures takes place the task before the farmer is the reconditioning of his soil-types so that the high-production, palatable grasses and clovers may be provided with the essential conditions that make it possible for them to persist and thrive.

Bulk of herbage and tallness of growth are the two major factors that operate to dominance of any one species or set of species. Those species possessing the inherent capability of high production will always dominate other species of limited production, provided always that the wherewithal is provided for the high producer to produce its maximum. Rye-grass has the inherent capabilities for high production, whereas a grass like danthonia is not capable of high tonnage per acre; brown-top has a capacity to produce higher than danthonia, but lower than rye-grass. Hence so long as the necessary conditions are provided for rye-grass to produce its maximum, danthonia or brown-top will be powerless to compete successfully against it; but allow the conditions to alter and to become unsuited for rye-grass, so that its yield rapidly diminishes, then brown-top will beat rye-grass in production and will be placed in a position of successfully competing against it. The same may be said of danthonia.

Tallness of growth is a very deciding factor also affecting the constitution of a mixed grassland association. Rye-grass under moderate

grazing will beat cocksfoot in production, but under light grazing the cocksfoot gets away on strong land and overtops the rye-grass, literally smothering it out by its taller, but not necessarily denser, growth.

The conditions for rye-grass dominance are different from those that favour cocksfoot dominance. Actually the rise to cocksfoot dominance indicates a weakness in pasture utilization, and, while the value of cocksfoot is fully recognized, yet it is quite unwise to endeavour to create the exact conditions for cocksfoot, else rank, non-milk-producing feed will predominate. The same may be said of red clover. To create ideal grazing conditions for red clover the pasture must be allowed to grow too rank for maximum milk-production. Maximum milk-production centres about that pasture that can be kept moderately short, ever producing young leaf, and dense in the bottom. Tallness of growth is no criterion of high milk-production—rather the reverse. The ideal growth, to my mind, is best attained in the perennial rye-grass and white clover dominant pasture. The conditioning of our grassland soil-types to the rye-grass and white clover dominant ideal is the task before every farmer—on arable land at least. We make rye-grass and white clover dominant the ideal, for then we know (1) that the physical conditions of the soil are perfect for high production—not too dry nor yet too wet; (2) that the soil-fertility upkeep is right; (3) that the utilization of the pasture herbage is correct; and (4) that the food consumed is of a high nutritive content—perfect for milk-production, whether by the dairy cow or the ewe.

Certain soils, then, it will be necessary to drain, for rye-grass cannot stand "wet feet" in the winter; most soils will have to be limed; all soils will have to be liberally supplied with phosphates, and later on most likely with a complete manure containing potash and nitrogen in addition to the phosphates and lime. The point I wish to make is that the rye-grass and white clover ideal is possible under nearly all grassland conditions in New Zealand, and that maximum production will not be secured until such ideal is attained. The pasture need not necessarily be limited only to these two species — crested dogstail, timothy, cocksfoot, paspalum, and other first-class high-production species should be included—but the management should be such that for the greater period of the year rye-grass and white clover are dominant.

At the present time the Department of Agriculture is initiating experiments on all leading soil-types to determine under ordinary grazing just what are the conditions necessary on each type for the attainment of rye-grass and white clover dominance. In the *Journal* for June, 1925, in an article presenting a preliminary ecological classification of grassland species, it was shown that the common grasses and clovers could be grouped, and that each had a more or less definite habitat range.

A second aspect fundamental to grassland improvement is the testing of strains of the different species. Just as species have been moulded to suit a particular set of environmental conditions, so too may there be variation in adaptability within the species itself; and ntred in the consideration of strain lies the fundamental conception possibilities of widening the habitat range of each species. Can

we by strain-selection widen the habitat range of rye-grass, cocksfoot, white clover, &c. ?

A further aspect in regard to strain, apart from the widening of the habitat range, is the nature of the herbage produced. Certain strains of rye-grass, cocksfoot, &c., may develop more towards leaf than towards stalk and seed, and the former characteristic from a grazing point of view must be greatly superior.

As with stock so with pasture-plants it is possible to feed poor strains, and it is going to be harder to secure our ideal unless greater attention is paid to the question of strain. For my part, I do not agree that it is wise to choose or to breed plants to suit impoverished conditions in our grassland soil-types. Rather do I claim that it is better to choose high-yielding species or strains of grasses and clovers, and to provide those with the conditions necessary for their persistence and growth. Permanent high production, in my opinion, is not possible on poor soils, and if we wish to grass our poor soils with strains of rye-grass and white clover—if this is possible—such strains must of necessity be low-producing strains.

For general permanent pastures (in the North Island, at least) the general opinion is that Hawke's Bay rye-grass is superior to Canterbury rye-grass. Canterbury rye-grass is very prolific for a start, but then it is very inclined to weaken and open up in the bottom; whereas Hawke's Bay rye-grass is somewhat shorter in growth, denser in the bottom, and more persistent under the average pasture conditions existing to-day. But are these conditions the optimum conditions for Canterbury rye-grass? Will it continue to produce if it is more highly fed? In other words, is Canterbury rye-grass bred up to a higher standard of production than Hawke's Bay rye-grass, and consequently demanding for its permanence better conditions than the latter? A similar comparison may be made between Kentish wild white clover (which is harvested from extremely old pastures in Kent) and the New Zealand old-pasture white. Under optimum manuring the taller-growing, larger-leaved New Zealand white clover will probably easily beat the Kentish wild white in production; but under a lower standard of soil-fertility upkeep the lower-producing Kentish will naturally be more persistent, because it is attuned by natural selection to a harder set of conditions. Here again our aim should be the conditioning of all land possible to high-production strains, rather than being content to see the ground covered by persistent but low-production strains.

Hand-in-hand with the work on conditioning soil-types to rye-grass and white clover dominance the testing of the different strains of the common grasses and clovers is being undertaken in one composite experiment. The scheme consists in laying down on each soil-type a series of plots in which perennial rye-grass and white clover figure as dominants in all sowings. In each plot, as far as the grasses are concerned, additional to the perennial rye-grass and white clover base, one other grass species or strain is included. In the case of the different clovers the base is perennial rye-grass, cocksfoot, crested dogstail, and white clover, and in each plot one other clover or strain of clover is added to the base. It is the intention to so manage and manure these plots that perennial rye-grass and white clover are maintained dominant,

and to study under such conditions which other species or strains persist and function best as subsidiary species in the sward.

Further, besides including all the first-class grasses and clovers and their commercial strains in the series, inferior grasses and clovers such as Yorkshire fog, brown-top, danthonia, ratstail, Chewings fescue, suckling clover, clustered clover, &c., figure in the experiment. The objective here is to determine on each soil-type how much and what kind of manure to apply in order to manure out these inferior species. It is not claimed that on all soil-types it will be economically sound to manure out all inferior species ; but it is well worth while spending time and money to determine just what quantity of manure and in what form it should be applied, in order to attain our objective and to determine actually what each £1 spent on manure does effect in directing the pasture towards the ideal here set down.

LOCATION OF PLOTS AND DETAILS OF SCHEME.

Last autumn experimental plots were laid down on the following soil-types at the places stated :—

(1) Central Development Farm, Weraroa : First-class country ; heavy alluvial river deposit ; fertile soil approaching the rye-grass and white clover standard.

(2) Marton Experimental Area, Marton : Heavy clay land ; typical brown-top soil-type—that is, brown-top comes in as a volunteer, and becomes dominant unless the quality of the soil is improved by systematic top-dressing.

(3) Katere Experimental Area, New Plymouth : Light, friable soil which runs predominantly to sweet vernal and danthonia, with rosette weeds of the catsear, rib-grass type. Typical natural sweet vernal and danthonia soil-type.

(4) Waimate West Demonstration Farm, Manaia : Typical Taranaki coastal country ; moderately light, friable, volcanic loam, its natural state of fertility bordering on the cocksfoot soil-type.

Each series of plots is laid down in triplicate or quadruplicate and arranged according to the accompanying plan (page 5).

At the beginning of each series pure sowings have been made of each species and strain used throughout the experiment, and in certain instances blank plots have been left for studying the volunteer growth that appears on each respective soil-type.

In the case of sowings where strain is involved, the lines of seed secured are in most cases blends of a number of lines all of the same origin. By this means a truer representative sample of any one particular strain is secured, and the chance of striking an exceptionally good or an exceptionally bad line of any one strain is very much reduced.

Each sowing is divided into four : first sector, no manure ; second sector, all phosphate manure ; third sector, no manure ; fourth sector, phosphate plus nitrogen and potash.

The kinds and amounts of manure will vary according to the soil-on which the experiment is laid down, and annual or twice-yearly ons will be made in order to keep rye-grass and white clover

Pure sowings of each species and strain included in base mixtures.

Sector 1 No manure — Sector 2 All phosphate — Sector 3 No manure — Sector 4 Phosphate, nitrogen, and potash

Series 1	Series 2	Series 3	Series 4
1	36	35	54
2	37	34	53
3	38	33	52
4	39	32	51
5	40	31	50
6	41	30	49
7	42	29	48
8	43	28	47
9	44	27	46
10	45	26	45
11	46	25	44
12	47	24	43
13	48	23	42
14	49	22	41
15	50	21	40
16	51	20	39
17	52	19	38
18	53	18	37
19	54	17	36
20	1	16	35
21	2	15	34
22	3	14	33
23	4	13	32
24	5	12	31
25	6	11	30
26	7	10	29
27	8	9	28
28	9	8	27
29	10	7	26
30	11	6	25
31	12	5	24
32	13	4	23
33	14	3	22
34	15	2	21
35	16	1	20
36	17	54	19
37	18	53	18
38	19	52	17
39	20	51	16
40	21	50	15
41	22	49	14
42	23	48	13
43	24	47	12
44	25	46	11
45	26	45	10
46	27	44	9
47	28	43	8
48	29	42	7
49	30	41	6
50	31	40	5
51	32	39	4
52	33	38	3
53	34	37	2
54	35	36	1

DIAGRAMMATIC PLAN OF STANDARD EXPERIMENTAL AREA, SHOWING DISPOSITION OF PLOTS. (DETAILS OF SOWINGS ON NEXT PAGE.)

The area totals 5 acres. Individual plots (sowings) measure $18\frac{1}{3} \times 120$ links = $\frac{1}{48}$ acre.

Details of Mixtures Sown in Plots of each Standard Area.

1. Base (*a*)* plus Western Wolths rye-grass, 10 lb.
2. Base (*a*) plus Italian rye-grass, 10 lb.
3. Hawke's Bay old pasture rye-grass (blend), 30 lb. ; N.Z. white clover (blend), 2 lb.
4. Hawke's Bay maiden old pasture rye-grass (blend), 30 lb. ; N.Z. white clover (blend), 2 lb.
5. Southland rye-grass (blend), 30 lb. ; N.Z. white clover (blend), 2 lb.
6. Sandon rye-grass (blend), 30 lb. ; N.Z. white clover (blend), 2 lb.
7. Canterbury rye-grass (blend), 30 lb. ; N.Z. white clover (blend), 2 lb.
8. Base (*a*).
9. Base (*a*) plus timothy, 10 lb.
10. Base (*a*) plus prairie-grass, 40 lb.
11. Base (*a*) plus meadow-fescue, 20 lb.
12. Base (*a*) plus meadow-foxtail, 10 lb.
13. Base (*a*) plus Poa trivialis, 5 lb.
14. Base (*a*).
15. Base (*a*) plus Akaroa cocksfoot (blend), 15 lb.
16. Base (*a*) plus Danish cocksfoot (blend), 15 lb.
17. Base (*a*) plus Plains cocksfoot (blend), 15 lb.
18. Base (*a*).
19. Base (*a*) plus Sandon crested dogstail (blend), 6 lb.
20. Base (*a*) plus Southland crested dogstail (blend), 6 lb.
21. Base (*a*) plus Poa pratensis, 5 lb.
22. Base (*a*) plus Australian paspalum, 10 lb.
23. Base (*a*).
24. Base (*a*) plus Waipu brown-top (blend), 5 lb.
25. Base (*a*) plus Southern brown-top (blend), 5 lb.
26. Base (*a*).
27. Base (*a*) plus Chewings fescue, 10 lb.
28. Base (*a*) plus Hawke's Bay Danthonia pilosa, 10 lb.
29. Base (*a*) plus Canterbury Danthonia pilosa, 10 lb.
30. Base (*a*) plus Danthonia semiannularis, 10 lb.
31. Base (*a*) plus ratstail, 2 lb.
32. Base (*a*) plus Yorkshire fog, 10 lb.
33. Base (*a*) plus red-top, 5 lb.
34. Base (*b*).†
35. Base (*b*) plus Marlborough red clover, 6 lb.
36. Base (*b*) plus Canterbury red clover, 6 lb.
37. Base (*b*) plus Wairarapa red clover, 6 lb.
38. Base (*b*) plus Montgomeryshire red clover, 6 lb.
39. Base (*b*) plus English trefoil, 4 lb.
40. Base (*b*).
41. Base (*b*) substituting volunteer Marlborough white clover, 2 lb.
42. Base (*b*) substituting Canterbury stubble white clover (blend), 2 lb.
43. Base (*b*) substituting old pasture N.Z. white clover (blend), 2 lb.
44. Base (*b*) substituting imported Polish white clover, 2 lb.
45. Base (*b*) substituting Kentish wild white clover, 2 lb.
46. Base (*b*).
47. Base (*b*) plus alsike, 4 lb.
48. Base (*b*) plus subterranean clover, 6 lb.
49. Base (*b*) plus Southland Lotus major, 2 lb.
50. Base (*b*) plus imported Lotus major, 2 lb.
51. Base (*b*) plus Lotus hispidus, 2 lb.
52. Base (*b*) plus suckling clover, 3 lb.
53. Base (*b*) plus clustered clover, 3 lb.
54. Base (*b*).

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* Base (*a*): Canterbury perennial rye-grass (blend), 20 lb. ; N.Z. white clover (blend), 2 lb. : total, 22 lb. per acre.

† Base (*b*): Canterbury perennial rye-grass (blend), 15 lb. ; Akaroa cocksfoot (blend) 10 lb. ; Southland crested dogstail (blend), 3 lb. ; N.Z. white clover (blend), 2 lb. : total, 30 lb. per acre.

dominant on each soil-type. The object of this is to determine the amount of manure required to build up and maintain each soil-type to perennial rye-grass and white-clover standard, and to study the reaction of such a sward on the individual species sown with the base species.

An amount of 3 cwt. superphosphate and 4 cwt. carbonate of lime per acre was applied uniformly over the whole series of each area at time of sowing.

It is not intended to keep records of the weights of herbage produced, and the plots are to be kept grazed.

As many of the areas as possible will be subjected to exact botanical analysis, and the point-quadrat method will be employed for determination of change and recording exact constitution of the pasture sward.

AIMS IN BRIEF.

Concisely expressed, the aim of the experiment is as follows :—

(1) Determination of fundamental ecological relation of each grassland species to soil-type under normal grazing-conditions and within a mixed association.

(2) Determination of fundamental ecological relation of "strain" and improved "breeds" of grassland species to soil-type under normal grazing-conditions and within a mixed association.

(3) Determination of succession from initial turf on each soil-type to natural climax under normal grazing-conditions, without top-dressing. In this it is expected to get a readjustment of species according to the natural fertility resources of the soil, and the ultimate climax will be a measure of the soil-type.

(4) Modification of soil-type so as to bring about or maintain conditions suitable for the persistence and thriving of high-yielding grassland species. Determination of amount, nature, and cost of manure to apply on each soil-type in order to bring this about.

(5) In addition there is the question of relationship of soil-moisture, light and shade, temperature, growth-form, relative palatability of the species, &c., under optimum grazing and optimum manuring.

CONCLUSION.

It appears evident that the two lines of research here outlined are really fundamental to grassland improvement. The conditioning of all the better soil-types at least towards the rye-grass and white-clover ideal may be regarded as the best immediate method of increasing production from the sown grasslands of New Zealand. For areas broken up for the first time, and those being relaid to permanent pasture, consideration of strain may add much to the wealth from grassland. We are probably far from maximum production, and even when the possibilities of our present species and strains are exhausted the way is open by plant-breeding to even higher production, provided always that equally improved conditions for plant-growth are created by the farmer. No choice of species, no consideration of strain, will in itself give permanent high production. It is only when coupled with conditions of the habitat under which the plants are asked to grow that sound improvement can be effected.

CERTIFICATION OF SEED POTATOES.

(Continued.)

INFORMATION GAINED FROM FIRST YEAR'S WORKING OF SYSTEM IN CANTERBURY.

J. W. HADFIELD, H.D.A., Agronomist, and J. H. CLARIDGE, B.Ag., Assistant Instructor in Agriculture, Christchurch.

THE matter here appearing has been prepared with the object of drawing attention to certain observations made during the progress of the past season's operations in the certification of seed potatoes in Canterbury, and it is hoped they will prove beyond all doubt the imperative need of some system whereby growers may be guided in the selection of the seed they plant.

The present standard of our potato crops in regard to purity and disease is to some extent indicated in the accompanying tables, while the variation in cropping-power of lines within a variety is abundantly proved. It is to be remembered that the crops upon which these observations are made were those entered for certification. They do not, of course, represent all the best crops in Canterbury, but they are most likely above the average, otherwise they would hardly have been entered, and the trial plots at Ashburton were planted with hand-picked seed sent in by the individual growers.

CROPS ENTERED AND REJECTED.

Table I gives a summary of crops entered and rejected in the field. The remainder have been passed provisionally, but some o. these are likely to be rejected during the final tuber-inspection which takes place when the seed is graded ready for sale.

Table I.—Summary of Crops entered and rejected in Field.

Variety.	Number of Lines entered.	Area entered.	Number of Lines rejected in Field.	Area rejected in Field.
		Acres.		Acres.
Dakota	28	286	16	165
Pink Beauty of Hebron ..	3	13	2	11
Early Rose	1	1	1	1
Robin Adair	4	7	1	1
White Beauty of Hebron	1	2	1	2
Early Puritan	2	..	2	..
Early Regent	1	35	..	..
British Queen	1	11	1	11
Bresee's Prolific ..	13	118	2	13
Auckland Short-top ..	22	134	15	60
Auckland Tall-top ..	8	43	3	13
Epicure	14	37	9	25
Arran Chief	23	127	19	91
Northern Star	1	35	..	..
Gamekeeper	1	5	1	5
Endurance	3	6	2	5
Up-to-Date	11	34	8	21
Total	137	894	83	424

A list of growers who have been issued provisional certificates was published in the May issue of the *Journal.*

ASHBURTON EXPERIMENTAL FARM TRIAL PLOTS.

Every grower applying for inspection was required to forward to the Ashburton Experimental Farm one hundred sets of seed-size potatoes taken from his particular line. In this way lines were collected from all parts of Canterbury, and were grown together on one area where they could be compared with one another. These plots served a very useful purpose. They were the source of much interest to the growers, assisted the inspectors in judging farm crops which—being grown on a wide range of soils—were of a most variable character, and, finally, served to present some information of great practical value.

Most of the seed was very carefully selected by the growers, and it is doubtful if last season an equal area in any part of New Zealand was planted with such apparently good-quality seed, yet some of it was quite worthless, as is indicated by the yields obtained.

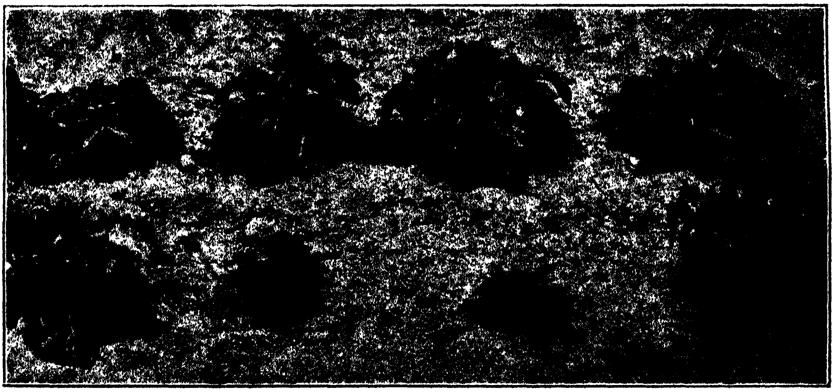


FIG. 1. SHOWING DEFERRED GROWTH DUE TO CORTICIUM INFECTION.

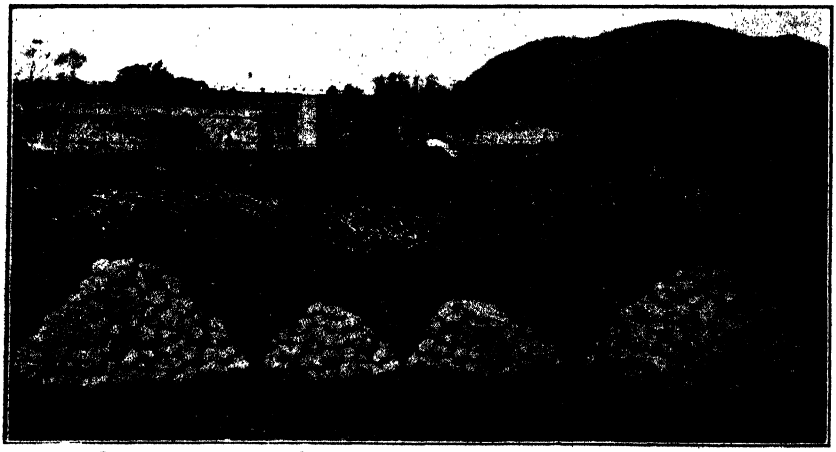
Note the two retarded plants in front centre.

The plots were planted on 12th and 13th October, and two months later the normal plants were from 9 in. to 12 in. high. A count was made at this time to determine the proportion of subnormal plants—that is, those plants in which growth was very much retarded (Fig. 1). In almost every case this pronounced delay was due to corticium infection, and this disease would appear to exercise a very serious drain upon the vitality of the plant. So far, no very definite information is available as to the amount of loss corticium may occasion, but the figures in Table 2 indicate that the proportion of infection, accompanied by serious retardation of growth, averages for all varieties 18·8 per cent. This average is arrived at after inspecting 13,300 plants, and the range of infection in different lines varies from 5 per cent. to 44 per cent.

Row 14. 5·3 tons. Row 13. 8·3 tons. Row 12. 3·6 tons. Row 11. 5·5 tons.

FIG. 2. SOME OF THE LINES OF DAKOTA UNDER TRIAL AT ASHBURTON EXPERIMENTAL FARM.

Figures given under different rows in photo refer to yield of table potatoes per acre. Note vigour and yield of row 13 compared with adjoining rows 11 and 12, both of which are carrying wilt-disease and early blight.



Row 13. 8·3 tons. Row 19. 2 tons. Row 21. 2·75 tons. Row 31. 8 tons.

FIG. 3. ACTUAL YIELD OF TABLE TUBERS FROM THE TWO HIGHEST AND THE TWO LOWEST CERTIFICATION LINES OF DAKOTA TESTED AT ASHBURTON.

The figures refer to yields computed in tons per acre.

Table 2.—Proportion of Deferred Growth due to Corticium Disease.

Variety.	Number of Lines inspected.	Average Percentage of Infection and Retardation.	Variety.	Number of Lines inspected.	Average Percentage of Infection and Retardation.
Dakota	27	22·5	Bresee's Prolific ..	14	20·2
Pink Beauty of Hebron	3	9·3	Aucklander Short-top	22	16·7
			Aucklander Tall-top	7	16·0
Early Rose ..	1	8·0	Epicure	14	14·8
Robin Adair ..	4	20·0	Arran Chief ..	22	19·7
White Beauty of Hebron	1	19·0	Northern Star ..	1	9·0
			Gamekeeper ..	1	14·0
Early Regent ..	1	16·0	Endurance ..	3	19·3
British Queen ..	1	24·0	Up-to-Date ..	11	20·9

Total crops, 133. Average for all lines, 18·8 per cent.

SUMMARY OF REJECTED CROPS.

The first field inspection was carried out during January and early February, when the crops were in full flower. The second inspection was made during April, when the haulms were maturing and the tubers could be inspected. Table 3 summarizes the position, but it must be noted that the information is far from complete. The records were not made for the purpose to which they are now being put, and an inspector who might on examination find a high percentage of foreign varieties might record the percentage as evidence for rejection, and disregard the possibility of the crop being liable to rejection for other additional reasons.

Of the 138 crops entered ten were wrongly named, but as five of those sent in as Magnum Bonum were pure lines of Bresee's Prolific they were accepted as such. Three crops were withdrawn, and six were not eligible, being under the minimum area of 1 acre. By far the largest proportion of rejections was occasioned by the presence of foreign varieties, more especially in the Dakota and Arran Chief varieties. The second field inspection over all varieties disclosed that approximately 29·7 per cent. of the plants examined were infected with wilt disease, as indicated by vascular discoloration. This late infection does not appear to reduce the yield to any appreciable extent, and for the present is disregarded as a factor in certification. The early wilt infection observed during the first field inspection to an extent of 1·5 per cent. appears to be more serious, and was taken into consideration.

CROPPING POWER.

The ultimate aim of certification is to improve production by propagating from the best lines, and the question arises, is there any great variation in the yielding-powers of one line of seed as against another line of the same variety? To this it can be asserted definitely that a very great deal of variation does occur, and that, irrespective of the variety, lines of seed are bought and sold which are quite worthless, incapable of producing any return, and a menace to successful potato-growing.

Table 3.—Summary of Rejected Crops.

Variety.	Number of Crops entered and inspected in First Inspection.	Causes for Rejection on First Inspection.			Number of Crops passed in First Inspection and again inspected.	Causes for Rejection on Second Inspection.					Number of Crops passed in Second Inspection and issued Provisional Certificates.
		Foreign Varieties.	Virus Diseases.	Early Wilt.		Foreign Varieties.	Eelworm.	Virus Diseases.	Late Blight.	Powdery Scab.	
Dakota	28	8	1	1	18	2	3	1	..	..	12
Pink Beauty of Hebron ..	3	1	..	1	1	..	..	..	..	..	1
Robin Adair	3	..	..	..	3	..	..	..	..	..	3
White Beauty of Hebron ..	1	..	1	..	..	..	..	..	..	..	..
Early Regent	1	..	..	..	1	..	..	..	..	..	1
British Queen	1	1	..	..	..	..	..	..	..	..	..
Bresee's Prolific	13	..	..	..	13	..	2	..	..	..	11
Aucklander Short-top ..	21	6	1	..	14	2	3	1	1	..	7
Aucklander Tall-top ..	8	1	1	1	5	..	..	..	..	..	5
Epicure	13	..	1	5	7	..	..	1	..	1	5
Arran Chief	21	16	..	..	5	..	1	..	..	..	4
Northern Star	1	..	..	..	1	..	..	..	..	..	1
Endurance	3	..	..	1	2	..	1	..	..	..	1
Up-to-Date	7	1	..	1	5	..	1	..	1	..	3
Totals	124	34	5	10	75	4	11	3	2	1	54

6·1 tons. 3·6 tons. 5·7 tons.

FIG. 4. THREE OF THE UP-TO-DATE LINES SENT IN FOR CERTIFICATION.

Centre row is badly affected with wilt-disease and early blight; row on right contains a number of "bolters." The figures under rows refer to yield of table potatoes per acre.

FIG. 5. BAGGED YIELDS OF TABLE POTATOES FROM RESPECTIVE ROWS SHOWN IN FIG. 4.

Most growers and merchants look upon certification as a helpful means of procuring varieties true to name, and, without detracting from this aspect of its value, the fact remains that the greatest benefit will be derived from the elimination of the unproductive and virus-infected lines. While there are no means by which the " scrub " crop may be condemned, this object is achieved indirectly through certification, by giving a stimulus to the distribution of the produce of healthy productive crops for seed purposes. So great is this variation that growers should pay as much attention to the origin of strain of the seed they intend to plant as they are in the habit of doing now in regard to its variety. It also leads to the conclusion that at the present

9·5 tons. 7·6 tons. 4·6 tons.

FIG. 6. PRODUCE OF EACH OF THE THREE LINES OF ENDURANCE POTATOES ENTERED FOR CERTIFICATION AND TESTED AT ASHBURTON.

The figures represent yield of table potatoes per acre. The highest-yielding row was rejected during the second field inspection on account of eelworm infection, and the lowest one owing to wilt-disease.

juncture potato variety trials are useless as an indication of cropping-power, since there is as much variation within the variety as is likely to occur between one variety and another.

YIELDS FROM THE ASHBURTON PLOTS.

The trial rows, each representative of a crop entered for certification, were grown under uniform conditions and in such a way that they could be very easily compared. Replication of the plots was not

possible, but so great were the differences that no amount of experimental error could account for the variations, and the point at issue is very clearly demonstrated.

It is to be regretted that time was not available to weigh all certification lines. This was done only in the case of three varieties—Dakota, Up-to-Date, and Endurance. It is probable that other varieties, with the possible exception of Bresee's Prolific, would have shown as great a variation as is proved to exist in the three varieties referred to. In Table 4 is recorded the yields of table tubers obtained, and Fig. 7 shows graphically the range of this variation in the

Table 4.—Yield of Table Potatoes in Certification Lines of Dakota, Up-to-Date, and Endurance, Ashburton Experimental Farm, 1927-28 Season.

Row No.	Tons per Acre.	Row No.	Tons per Acre.	Row No.	Tons per Acre.
			Dakota.		
13	8·3	7	5·7	32	4·5
31	8·0	11	5·5	35	4·5
6	7·8	14	5·3*	12	3·6
8	7·6	34	5·3	15	3·5
33	6·8	16	5·2*	30	3·2†
10	6·4	23	5·2	24	3·1
22	6·1	17	4·9*	18	3·0†
5	6·0	25	4·8	21	2·7†
26	5·9	20	4·7	19	2·1
9	5·8				
			Average, 5·2 tons per acre.		
			Up-to-Date.		
150	7·4	141	5·6	147	4·4
144	6·1	143	5·3	140	4·3
142	6·0	148	5·3	145	3·6
146	5·7	149	4·9		
			Average, 5·3 tons per acre.		
			Endurance.		
135	9·5	134	7·6	133	4·6
			Average, 7·2 tons per acre.		

* Seed originated from the one grower. † Seed originated from the one grower.

Dakotas. This range extends from 8·3 tons down to 2·1 tons of table in the case of Dakota, from 7·4 tons to 3·6 tons in Up-to-Date, and from 9·5 tons to 4·6 tons in Endurance. It is interesting to note that the highest-yielding line in both Dakota and Up-to-Date was sent in by the one grower. His crops, which were grown on very light land, were, from the point of view of yield, among the poorest inspected. Had it not been for the trial plots at Ashburton the cropping-power of his lines would not have been discovered, except that he happens to be a recognized grower of high-class seed.

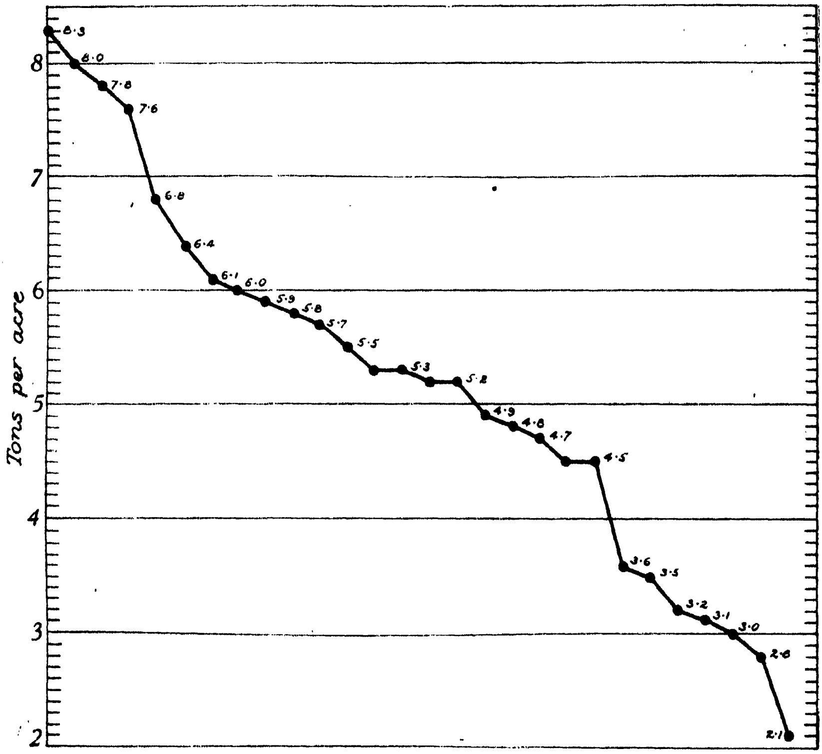


FIG. 7. SHOWING GRAPHICALLY THE RANGE IN YIELD OF TABLE TUBERS PER ACRE OBTAINED FROM TWENTY-EIGHT CERTIFICATION LINES OF DAKOTA AT ASHBURTON.

CAUSE OF UNPRODUCTIVENESS.

The reason for certain lines being unproductive cannot be discussed here at any length. The great majority have "run out" or degenerated, and some growers who are paying marked attention to purity are badly neglecting the general health or cropping-powers of their crops.

Degeneration is almost entirely due to the group collectively referred to as "virus" diseases. So far as is known, the condition is not brought about by ordinary fungi, bacteria, or micro-organisms, hence the term "virus," but they are nevertheless diseases, since they can be transmitted by grafting, by the juice of infected plants, and in the field by the agency of insects such as the green aphis so common on the potato-plant.

The various forms of virus disease have been or are being classified, and, without going into the question here, growers will no doubt recognize by the illustrations in this article conditions observed in their ·n crops. (Figs. 8, 9, and 10.) Instances in which the old tuber does

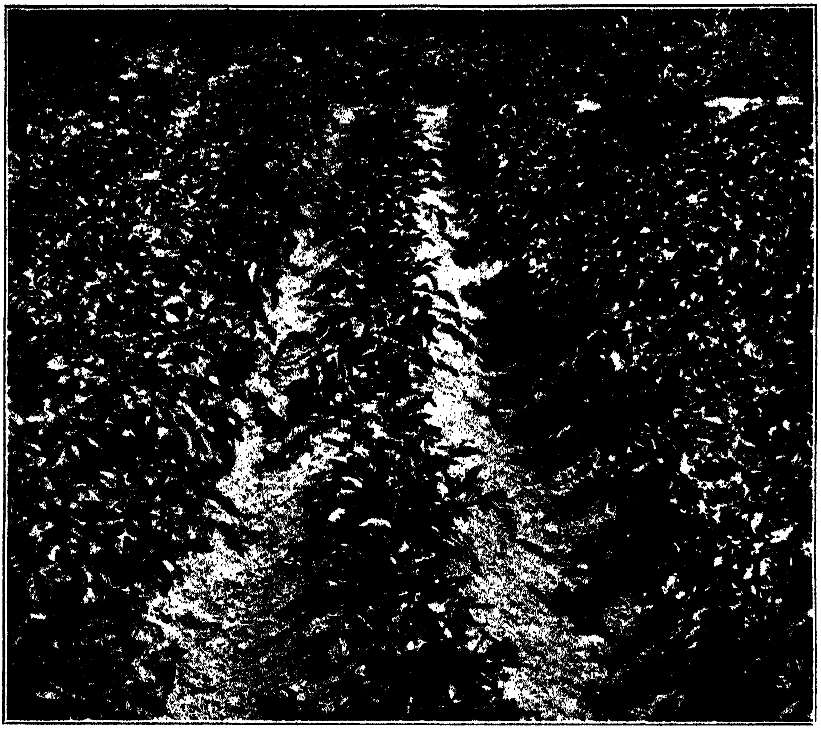


FIG. 8. LINE OF POTATOES (CENTRE ROW) BADLY "RUN OUT" WITH LEAF-ROLL.

Such plants are a menace to healthy plants around, and to healthy crops in the neighbourhood, infection being spread in the field by insects such as green aphis.

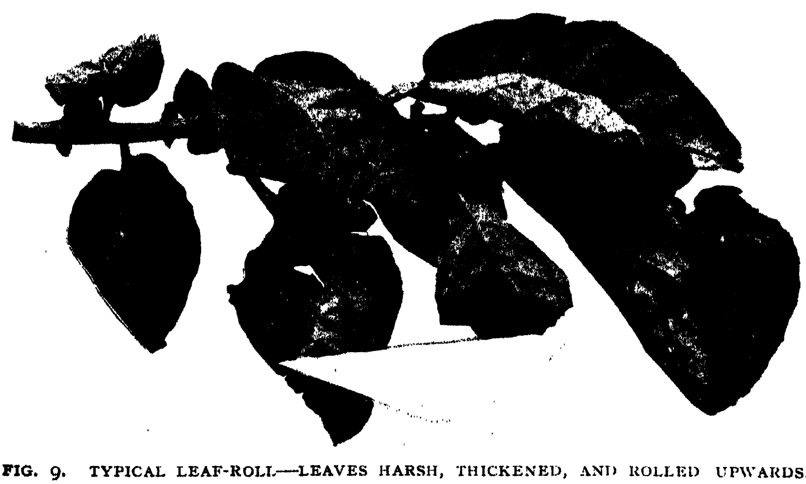


FIG. 9. TYPICAL LEAF-ROLL—LEAVES HARSH, THICKENED, AND ROLLED UPWARDS.

FIG. 10. STUNTED PLANT (IN FOREGROUND) AFFECTED BY SEVERE MOSAIC DISEASE.

Leaves have a mottled appearance and are generally crinkled. Yield is substantially reduced. Remarks on leaf-roll also apply to mosaic.

not rot away are common, and form an easily recognized symptom of virus disease. That such plants produce a poor yield is commonly observed by diggers, and seed from such roots, or from crops where this peculiarity occurs frequently, should not be used for planting. The symptoms of virus disease vary according to variety and climate, and so far it has not been possible to determine its presence from an examination of the tubers, these being quite normal and healthy in appearance. The important point is that virus diseases cause a very great reduction in yield; that tubers carry the disease so effectively masked as to baffle recognition; and that once a tuber is diseased all its stock is apparently permanently and incurably affected.

Noxious Weeds Orders.—Barberry has been declared to be a noxious weed in Takaka County, and hemlock in Marton Borough. The Maniototo County Council has declared gorse *not* to be a noxious weed within that county.

FROST-PREVENTION FOR ORCHARDS.

(Continued.)

W. R. LLOYD WILLIAMS, F.H.A.S., Orchard Instructor, Alexandra.

II.—FROST AND ITS OCCURRENCE.

THE fruitgrower who successfully controls disease in his orchard is one who knows something of its nature and methods of attack. In the same way, any one making an endeavour to prevent damage to his orchard or garden by frosts should at least have an elementary knowledge of the physical principles involved in the production of frost before he can hope to make a success of orchard heating.

When the temperature of the air falls below 32° F. there is said to be a frost. A frost may be a "white frost," when it is made patent by the appearance of crystals of ice or hoarfrost on exposed objects, or a "black frost" which can only occur when the atmosphere is very dry. In a black frost the dew-point is below the air temperature at the time of the frost. As is more fully explained below, a frost in temperate latitudes is usually confined to the layers of air near the surface. If the whole mass of the air, including that in the higher layers, is below freezing-point the condition is described in America as a "freeze." A freeze may accompany either a black or a white frost.

Temperature Inversion.

Should the day be warm and sunny the ground-surface is heated very considerably by radiation from the sun until its temperature becomes higher than that of the air in contact with it When this occurs the latter is warmed by conduction of heat from the ground. This heated air rises, and is continually being replaced by cold air from above. The former continues to rise until it reaches air of the same temperature as itself. Any layer of cold air near the surface is thus gradually warmed up, so that by the middle of the morning the temperature of the air is highest near the ground. This state of affairs continues until about 3 p.m., when the amount of heat radiated from the ground begins to exceed that received from the sun and the ground temperature begins to fall. Soon the ground begins to cool the air in contact with it, thereby reversing the order of things and making the air near the ground colder than that higher up.

Fortunately for the grower intending to heat his orchard, atmospheric cooling does not usually extend to great heights, the temperature rising from the ground upwards until a height is reached when there is very little variation. This phenomenon is known as "temperature inversion," and is what makes orchard heating possible. The feasibility of heating depends on the existence at a moderate elevation above ground of a layer of air which is above freezing-point. With the same ground temperature, heating will be easier the more marked the inversion. The warmed air from the heaters rises, at the same time imparting heat to the surrounding air, until it reaches a height where its temperature is the same as that of the air with which it comes in

contact. The level at which the temperature of the surrounding air is higher than that of the heated air forms a "ceiling" or "blanket" which the heated air cannot penetrate. The process of heating, therefore, needs only to be carried on until the temperature of the air below the "inversion" is all above freezing-point or whatever is regarded as the dangerous temperature. It is not necessary to "heat the whole atmosphere" as many people think, but merely the layer below the "ceiling." The inversion will be more or less pronounced according to the weather. If a strong wind is blowing, the different air-layers are mixed together and there will be no inversion. If the sky is cloudy the ground does not lose so much heat by radiation, so that the inversion is poorly developed. If a low temperature is experienced under these circumstances, therefore, heating is likely to prove difficult. On the other hand, the clearer and the stiller the atmosphere and the warmer the previous afternoon the more pronounced is the inversion likely to be. It is clear that in a "freeze," even if there is an inversion, heating must prove impracticable. The heating can be carried on until the inversion is removed, but thereafter the heated air will rise indefinitely and be carried away, while the body of the air still remains below freezing-point. It is possible that there was a freeze on the occasion of Field Test No. 3 (recorded in last month's *Journal*).

Several experiments were conducted to test the temperature inversion. (1) Temperatures were taken by Mr. Glasgow in a deep well-like hollow at the north-west corner of Mr. Bringans's orchard, between it and the dredge tailings. The hollow was some 35 ft. deep, cone-shaped and about 60 ft. across at the top. Following were the results, the figures representing degrees Fahrenheit.

Table 9.

—	13th Sept.	14th Sept.	15th Sept.	16th Sept.
Minimum at top of hollow	27·0	46·0	43·8	37·8
Minimum 15 ft. down	25·5	44·0	41·0	35·5
Minimum 33 ft. down	23·5	39·0	39·0	31·0

(2) On the night of 10th September, in conjunction with Mr. Glasgow, a more comprehensive test was arranged, the Alexandra Fire Brigade kindly allowing us the use of their practice stand and ladder in the recreation reserve for the purpose. Temperatures were taken regularly from midnight to 7 a.m. The thermometers, fully exposed, were placed at the following heights from the ground: (*a*) 1 in., (*b*) 1 ft., (*c*) 4 ft 6 in., (*d*) 10 ft., (*e*) 18 ft. From the accompanying graph (Fig. 13), which shows the temperatures recorded by each instrument at the times indicated, it will be noted that the lowest temperatures recorded were—(*a*) 26·8° F., (*b*) 26·0°, (*c*) 29·2°, (*d*) 30·9°, (*e*) 32·5°. In other words, at 1 in. there were 5·4 degrees of frost; at 1 ft. there were 6 degrees, at 4 ft. 6 in. there were 2·8 degrees; at 10 ft. there were 1·1 degrees; and at 18 ft. from the ground the temperature was half a degree above freezing-point—a difference of 6·5 degrees between the 1 ft. and 18 ft. levels. The fact that the lowest thermometer read

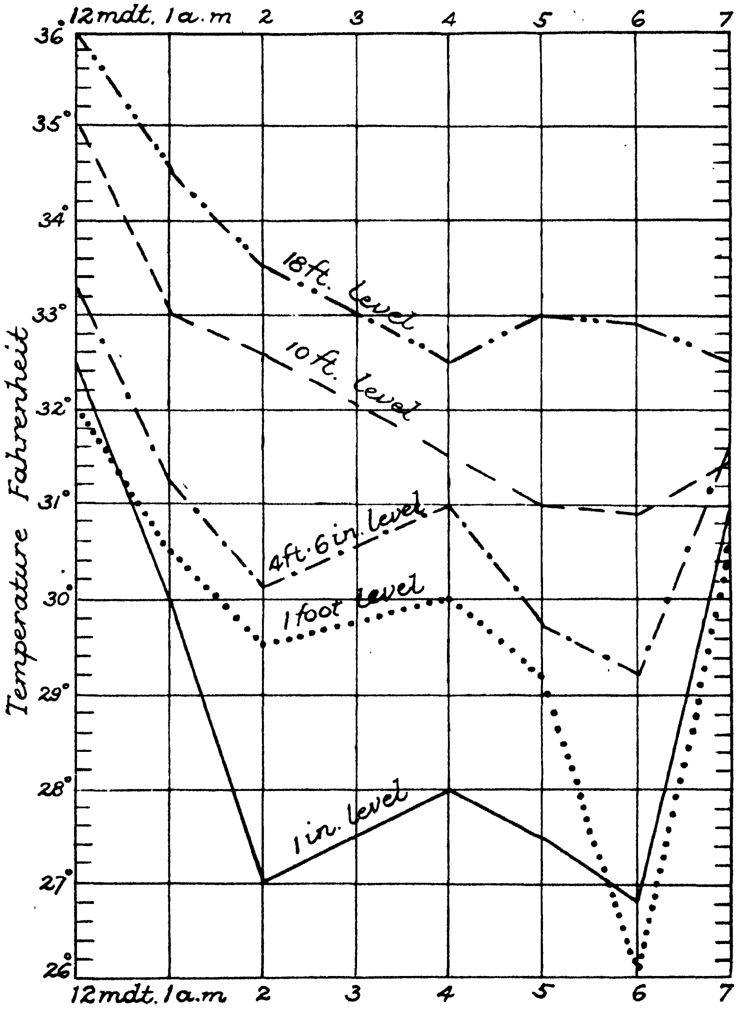


FIG. 13. GRAPH ILLUSTRATING TEMPERATURE INVERSION.

Experiment conducted 10th September, 1927, on Alexandra Fire-brigade's practice stand to ascertain temperatures at varying heights on a frosty night.

somewhat higher than that next above, was probably due to some defect in the instrument or its exposure.

(3) Tables 4 and 5 (last month's article) show differences in readings between thermometers A (4 ft. 6 in. level) and A/14 (14 ft.), up to 2½ degrees, while Table 4 also shows thermometers F (4 ft. 6 in.) and F/14 (14 ft.), inside the heated area, with differences up to 3½ degrees, these figures are despite the fact that the thermometers at 14 ft. were fully exposed and the others were under ordinary shelters.

Factors influencing the Occurrence of Frost.

(1) THE WEATHER.

This aspect may best be introduced here by reproducing the following extracts from an article on the "Protection of Orchards from Frost," by Dr. E. Kidson, in the *New Zealand Journal of Science and Technology* for November last :—

If the atmosphere is humid frost is less likely. The dew-point is the temperature at which the air would be saturated by the existing amount of moisture—*i.e.*, the temperature at which it would be unable to take up any more moisture by evaporation. The minimum temperature is not likely to fall much below this, for once the dew-point is reached any further fall results in the condensation of water vapour. In the process of condensation it gives off a large amount of heat, and the fall of temperature is consequently checked. If, further, the temperature is low enough to cause the condensed moisture to freeze, still more heat is evolved. It is therefore difficult to cool the air much below its dew-point. Frequently when the dew-point is reached a ground fog will be formed, and this itself will tend to protect the trees from frost-action.

The cold air in the surface layers, being dense, or having a greater weight for the same volume than the warmer a few feet higher above the ground, will tend to flow over a land surface very much in the same way as water does. It will flow off the ridges into the gullies, and flow off sloping land into the valley-bottoms. On slightly undulating country it will collect in the hollows, producing what are called in America "frost pockets." Regions which receive the drainage from a large, cold mountain area, especially if it is snow-clad, will be more liable to damage than others. A gentle slope will be less frosty than the plain below. On a slope the ridges will be warmer at night than the hollows.

In some positions, such as a narrow gorge, the currents of cold air will converge until a moderate wind is caused, and the air-turbulence produced by the wind will result in the warm air from above being mixed with the cold surface layers, and a considerable rise in temperature will follow. Such a site may not, therefore, be as subject to frost as most of the surrounding country. There are several instances of this state of affairs in Central Otago. Cold currents may be deflected by steep hill-slopes, and so pursue a somewhat erratic course over the ground. It must be remembered that, owing to the decrease of temperature with height, the higher the altitude of a locality above sea-level the more it will, in general, be subject to frost.

The conditions which favour the production of frost are a clear, dry atmosphere and calm or only light winds, which at the same time allow the earth to radiate heat freely through the night sky, and the air which is cooled by contact with the ground to collect in a cold surface layer. Such conditions are found practically only in anticyclonic weather.

The weather in New Zealand is produced by a series of low-pressure waves or barometric depressions followed by areas of high pressure or anticyclones, all moving from the westward. As a depression approaches from the Tasman Sea the barometer will fall, and the winds will generally be from some northerly direction. Since they blow from lower latitudes, they bring warm and moist air with them. When the area of lowest pressure, or the "trough" of the depression, has passed there will be a change to southerly winds, which is usually fairly sudden. The southerly winds, coming from higher latitudes, flood the country with cold air. During this stage the barometer rises, and the weather, which has been generally wet and cloudy during the period of low pressure, gradually clears. As the crest of the wave of high pressure or the centre of the anticyclone approaches the winds fall off. The weather then will generally be clear, calm, and cold, especially over inland areas, and in the proper season frosts are likely. Frosts should be looked for, therefore, when the barometer is high and rising after a period of cold southerly winds. If snow has fallen on the surrounding country, or that lying to windward, the chances of frost are very much increased. On the other hand, if the ground is soaked with rain the danger is reduced.

The following remarks made by Dr. Kidson in a letter to the writer are also interesting and instructive :—

It is noted that the damaging frosts generally seem to be preceded by falls of snow or hail. There are various reasons why this should be so. First, these phenomena indicate low general temperatures. Hail also indicates a rapid fall of temperature with height, and therefore a cold upper air. Clear, still conditions are likely to follow these phenomena. Second, the snow surface radiates freely, and would produce cold air, which would drift down from the mountains. Third, a snow surface is about a fourth or a fifth as efficient a user of the sun's heat as a grass surface, so that there is not so much heating of the air during the daytime when the snow is about.

In the Alexandra district, which is near the foothills of the mountains, and in a region which is very broken, there appears to be comparatively little stagnation. There is, probably, also a considerable Föhn effect, producing relatively warm conditions. This is indicated by the warm temperatures which it experiences in spring for a station at such an altitude and in so high a latitude. Also, where there is a concentration of wind-currents, as in the Cromwell Gorge, these are sufficient to prevent severe frosts. Some such explanation is needed, too, to account for the fact that apricot-growing is so successful in the district. The critical months, September to November, especially the two last, are months in which strong westerlies prevail. The Föhn effect is therefore likely to be considerable. The liability to frost is consequently rather lower than in the Hastings district, where the mountains are more distant and lower, while the westerly winds are not so strong. In the Manuherikia Valley and the Upper Taieri there are more chances of stagnation and frost; in the Manuherikia because its is a wide valley in which the down-dropping winds have space in which to die down, and in the Taieri because, in addition, it is too far east for the Föhn effect to be felt to the same extent. These facts, while explaining the relative freedom of Alexandra from frost, also make it probable that temperature inversions are not likely to be so pronounced as in plain country, and that heating will be more difficult.

The Föhn wind mentioned is a warm wind from higher levels. Its warmth is accounted for by the increased pressure to which the air of which it is composed is subjected at the lower levels. At 5,000 ft., for instance, its temperature may be freezing-point, 32° F., and the pressure 25 in. When it reached sea-level its pressure would be about 30 in., and its temperature would be raised to 59° F. The effect is the same as that experienced when you pump up a bicycle-tire. The tire and pump get hot.

Many of Dr. Kidson's references have a very direct local bearing —for instance, the absence of damage in the Clyde–Cromwell gorge through which the Clutha River runs. Again, the formation of "frost pockets" is probably one of the main reasons why portions of Mr. Bringans's and adjoining orchards are almost invariably more or less frosted. Also, the reference to a gentle slop being less frosty than the plain below was well exemplified in the 45-acre orchard of Mr. R. T. Symes at Fruitlands. In this instance, on the lower portions the whole crop was frosted; part-way up, where the ground rises, a part crop was left; while at the top end, where there is a sharp rise, a full crop was harvested.

It has been stated, quite unscientifically, that damaging frosts never occur with the wane of the moon. Local experience last season was most interesting, and should refute such a misleading statement. There were frosts on the following mornings, the state of the moon being shown in parentheses: 28th August (new moon, 27th August); 17th September (full moon, 12th); 5th October (first quarter, 4th); 25th October (new moon, 26th); 14th and 15th November (full moon, 9th); 8th December (full moon, 9th). As will be noted by the experiments, the worst frost was that on 14th

November, followed by a less severe one the following day, when the moon was on the wane.

COVER-CROPS.

The question of cover-crops (or a cover of grass and weeds) appears to be a debatable one which requires further investigation. Several instances have been noted or brought under my notice which might lead one to believe that there is more danger where the ground is covered with a crop than under clean cultivation. These cases may be coincidences, and therefore it is wise not to be dogmatic on the subject until further looked into. Mr. P. A. Royds, an Alexandra tomato-grower, had one row of tomatoes on the south-east side of his patch, beside long grass, badly frosted by one of the earlier frosts, while the rest of the plot was untouched. The row was replanted, and was again badly frosted on 8th December, while the adjoining rows, although damaged, were not nearly so bad; at the same time the row at the other end of the block (north-west side), right alongside some green oats, was also badly frosted. Mr. Royds states that he always finds strawberries to be worse frosted in weeds than under clean cultivation; this happened in a nearby garden (Turner's) last season. He also states that some years ago one orchard in grass (McLean's) was the only one frosted, the surrounding ones being cultivated. At Mr. M. P. McGinnes's orchard, Earnscleugh, there are two long rows of Roxburgh Red apricots side by side, with a strip of grass running along the side of one of them. The latter row showed a light crop, while the other, only a few feet away, carried a good crop. Some orchards under cover-crop in the Earnscleugh district were appreciably damaged by frost while an adjoining cultivated one (certainly on slightly rising ground) received little injury. On the other hand, temperatures taken by me at 1.45 a.m. on 5th October, at 2 ft. 6 in. above the ground, registered alike—29° F.—on ploughed and unploughed ground, showing that further investigation is necessary.

SHELTER.

The matter of shelter forms a most difficult problem. It is generally accepted that the few rows of orchard trees on the leeward side of a windbreak are less injured by frost than those further away. This was noticeable at Mr. Hinton's orchard, the few rows near the road (southern) boundary, on which there is a poplar shelter, were not damaged as much as those a few rows away. At the same time it must be borne in mind that on the windward side the frost will be more severe. Moreover, shelters are likely to interfere with air-drainage, which is so essential in keeping the air moving and so preventing a frost. Much thought must be given the subject before providing shelter against frost, for the frost may not come exactly from the same direction each time, with the result that a shelter may prove the reverse and act as a stop-bank to prevent the outflow of cold air.

IRRIGATION.

Running water, which gives off heat as it cools, affords only a small amount of protection. If, however, no other means are available Californian authorities advise the running of water both day and night

during the whole period of the frost, but that it should only be looked upon as a means of partial rather than complete protection. In Mr. Royds's tomato patch last spring it was noticeable that the portion irrigated was only slightly frosted, and that the drier parts were frosted out, although some plants on the slightly higher ground in the driest part were untouched.

III. ECONOMIC FACTORS.

Injurious Temperatures.

Unfortunately, we have no local data sufficiently reliable on which to base an estimate of the temperatures which cause injury, and must therefore, in the meantime, rely upon American experience. The following extract is taken from Bulletin 398 of the Berkeley College of Agriculture of the University of California :—

Temperatures endured for Thirty Minutes or Less (Sheltered Thermometers) by Deciduous Fruits in various Stages of Development.

Kind of Fruit.	Stage of Development.		
	Buds closed but showing Colour.	Full Bloom.	Small Green Fruits.
	° F.	° F.	° F.
Apples	25	28	29
Peaches	25	26	29
Cherries	25	28	30
Pears	25	28	30
Plums	25	28	30
Apricots	25	28	31
Prunes	26	28	30
Almonds	26	27	30
Grapes	30	31	31

The fruit-buds of nearly all deciduous fruits are extremely susceptible to damage during the period of from twenty-four to forty-eight hours before they open. The petals are still folded, but the flowers are growing rapidly and are extremely tender. Buds in this condition are often injured by temperatures as high as those given in the table for small green fruits. Fortunately, most deciduous fruit-trees come into full bloom gradually, so that even if all the buds about to open at one time are killed, the size of the crop is not reduced materially. Buds of the Bosc pear often open simultaneously, and a low temperature just before the flowers open sometimes destroys most of the crop.

At the time generally designated "full bloom" most deciduous fruit-trees have large numbers of fruit-buds which are still tightly closed, in addition to the flowers which are fully open. This makes the loss of the entire crop, or even the greater portion of the crop, on one cold night, extremely improbable at this stage. This has led fruitgrowers in some districts to believe that frost can do no damage before the fruit has set. Some growers even follow the hazardous practice of leaving heaters unlighted on frosty nights during this period. While a single frost at full bloom seldom affects the size of the final crop, a series of heavy frosts, each killing a portion of the blossoms, may leave too few undamaged buds or blossoms for a full crop.

The most dangerous stage in general is after all the petals have fallen and the fruit has set. All the fruit being in nearly the same condition, the entire crop may be killed in a single night. It is at this time that orchard-heating operations should be most carefully conducted. Apples and pears at this stage of development usually are not seriously injured by a temperature of 28·5° F. for thirty

minutes or less, provided the duration of temperatures below 32° F. does not exceed three hours. If the temperature drops to 29° F. only a short time before sunrise and has not been below 32° F. more than three hours, heating is unnecessary. However, if it appears that the lowest temperature during the night will be below 29° F., or if the temperature falls below 32° F. more than three hours before sunrise, heaters should be lighted and the temperature maintained as near 31° F. as possible throughout the remainder of the night. Small green apricots are extremely tender just after the shucks (dried calices) have dropped and before the pits have hardened. Apricots in this condition have been injured at long-continued temperatures of 31° F., and many growers think it necessary not to allow the temperature to fall below 32° F. as long as the pits are soft.

Different varieties of the same fruit often differ considerably in their susceptibility to frost damage. The Delicious apple appears to be more tender than most other varieties of apples grown commercially on the Pacific Coast. The Bosc pear is more susceptible to damage by frost than most other varieties of pears at similar stages of development, while the Winter Nelis is hardier than most varieties.

Frequency and Severity of Frosts.

Practically no scientific data are available as to the occurrences of frosts in Central Otago, but there is quite an appreciable amount of information of a practical nature. The main data from which these deductions are made are the temperatures taken by the Astronomical Society during 1922 and 1923 at Alexandra, Mr. H. E. Stevens from 1916 to 1921 at Clyde, and Mr. W. Bringans from 1919 to 1927 at Alexandra, and general talks with old-established growers. Although the information received from these sources cannot be wholly relied on, as temperatures have been taken in different situations and with non-standard thermometers, it must not be forgotten that the matter of frost damage has always been of vital interest to the fruitgrowers, and they naturally have a very good idea of what number of degrees of frost recorded by their own instruments would injure their crops.

During the years 1916 to 1927 inclusive there appears to have been an average of under three frosts per year which might have done more or less injury. From Mr. Bringans's records it would appear that his orchard received a certain amount of injury (not always more than a heavy thinning) from two frosts per year over the last nine years. The largest numbers were in 1919 and 1920, when there were six and four frosts respectively. The most severe frost recorded was one of 9°, which occurred in both 1919 and 1926, the temperature being observed by means of a thermometer placed on the ground in an exposed position. It would therefore be fairly safe to assume that the average is very little more than two frosts per annum for which heating will be required. For the longest frost experienced last season one and three-quarters hours' burning would have been sufficient for protection. To be on the safe side, therefore, and to allow for false starts, my estimates are based on an annual average of three heatings of two hours each.

Losses and Character of Injury.

Losses from frost damage are injurious to the whole community as well as to the fruitgrower and his industry. The grower is injured through lack of income, and his general inability to give his orchard that care and attention which is necessary whether there is a crop or not. This was very noticeable in Central Otago as a result of the 1926

frosts, when spraying, irrigation, cultivation, and other essential work was neglected. Moreover, the orchardist has all his overhead expenses, such as interest or rent, to pay, and the damage occurs after his pruning and ploughing have been completed, much of his spraying done, and most of his supplies ordered for the season. The Government suffers through the lesser tonnage carried on the railways, and the smaller amounts collected in income-tax and Customs duty. The industry generally receives a set-back through high prices forcing consumers to turn to other products, the lack of continuity of supplies being an important factor in the marketing of any commodity.

Sufficient details are not available to gauge the actual loss through frost sustained by growers in this district, but some idea may be gained by a comparison of the railway returns kindly supplied by Mr. C. Ashley, Stationmaster, Alexandra. The total weight of fruit railed from the railway-stations from Cromwell to Lauder on the Otago Central line for the years ended 31st March, 1926 and 1927 respectively, was 3,584½ tons and 2,616¼ tons, showing a decrease of 968 tons in the year of the severe frosts. This weight approximately equals 45,000 bushels. The following are the amounts of fruit (practically all stone-fruit) railed from Alexandra in the years 1921 to 1928 during the months of January and February, together with comments on the amount of frosting experienced :—

Table 10.

Year.	Tons.	Remarks.	Year.	Tons.	Remarks.
1921 ..	391	Considerable amount of frost.	1925 ..	862	Some apricots frosted.
			1926 ..	736	A little frosting.
1922 ..	744	Some frosting.	1927 ..	145	Very severe damage by frost.
1923 ..	946	Very little frosting.			
1924 ..	938	No frosting.	1928 ..	885	A little frosting.

The total loss estimated by the local fruitgrowers' association as a result of the 1926 frosts was £25,000 to £30,000—probably a conservative estimate. Although the losses at times have been heavy the district, apart from frosts, is so eminently suited to stone-fruits that growers who had been established for any length of time were quite well able to weather the storm. Moreover, it must be remembered that as one swallow does not make a summer, neither does one frosty season mean a failure, or greatly depreciate the many natural advantages possessed by Central Otago as a stone-fruit-growing area. The alarmist reports broadcast over the country have often been greatly exaggerated to the detriment of the industry.

There are also frost losses of a different character to be taken into account, such as malformations which make only second-grade fruit. Some varieties of apples and pears show an ugly russeting around the eye, while some pears, such as Williams Bon Chretien, develop a wide russet ring around the fruit. Another injury noticeable, especially on Cleopatra apples (Fig. 14) is the formation of small depressions or dents on the surface of the fruit which have the appearance of bitter-pit. When the skin is peeled there is nothing apparent but a slightly darker

green appearance. If cut a little deeper a corky layer is reached, and below this again is a distinct hole which has evidently healed over and does not appear to have any detrimental effect on the keeping-qualities of the fruit.

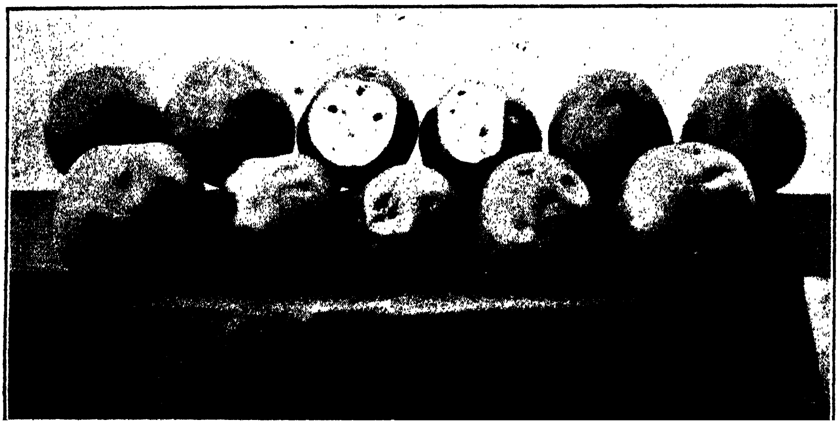


FIG. 14. FROSTED CLEOPATRA APPLES.

Note the depressions on the surface of the skin. On the cut apples will be seen the corky material near the skin and the holes where the cut is deeper.

Mr. J. R. Laing has noticed that "strong-growing trees of any variety stand the frost better, and carry heavy crops while the weaker trees among them are almost barren. Jonathan, Sturmer, and Cox, if they are frosted at the blossom stage and are heavily spurred all over, will throw out fresh blossoms and bear fair crops. Delicious and Cleopatra do not possess the recuperative powers of the others. Apples have, so to speak, five lives: when properly set they have five pips. Should they all be frosted but one there is a chance of the apple growing, although it will be badly shaped. Good apples may be grown with only two, three, or four pips; the difference is that they are flatter in shape and have not the substance of a perfect apple."

It was very noticeable during the season 1926–27 that pears, particularly Winter Cole and Winter Nelis, were dropping for no apparent reason at different times when they had nearly reached full size. Upon being cut, invariably the seeds were affected; one, two, or at most three of the seeds on one side would be full-grown and plump, the rest being shrivelled; moreover, in spite of light crops, these varieties did not size up as was naturally expected.

Will Frost-prevention Pay?

The individual grower is the only one who can finally answer this question. There appears to me to be three factors which should guide growers in this district in their decisions: (1) Is sufficient damage being done by frost to warrant the expense of protection? (2) Do damaging frosts occur so frequently that the cost

of protection would be too high? (3) Is the orchard sufficiently remunerative, irrespective of frost, to protect? There are orchards here that would not pay to protect from any of these points of view. Those orchards situated in favoured positions, such as the Clyde-Cromwell gorge, are frosted so seldom that the expense is certainly not warranted. Again, there are parts of the district with orchards in which, I am afraid, protection would be too costly, on account of the too frequent occurrence of damaging frosts. Then there are orchards that are not producing sufficiently large crops to warrant the additional expense, and which, until they can be brought into better profit, must be allowed to suffer occasional damage, for the cost of protection can easily be greater than the net profit on the crop saved.

There will always be failures on the part of those who do not exercise sufficient care and forethought, and there will always be a number who will not undertake protection against frost in any form. Therefore, for the successful frost-fighter there will be the higher price for his product in the years when frost takes toll of his neighbours' crops. In this district, with its dry autumn, the buds ripen to perfection, with the result apparently that, barring frosts, a full crop is assured each year almost invariably. Thus, with the frost bogy out of the way growers can with confidence apply manures and other assistance to their trees, with the almost sure knowledge that they are fertilizing a crop, instead of the present uncertainty. In the United States there is an annual increase in the acreage under protection from frost, and I feel that the same will be the case here. This conjecture is strengthened by the opinion of Dr. Kidson, as expressed to the fruitgrowers, that "it seems probable that frost-protection by artificial heating will be a paying proposition for many growers in Central Otago."

Community Organization.

Quite a considerable amount of co-operation is already being carried out by the fruitgrowers through their association in the purchase of equipment and fuel, and this has proved very beneficial, for such items as firepots become much cheaper when bought in large quantities. It seems probable that financial assistance can also be arranged to cover the initial costs of installing frost-fighting equipment through the intermediate rural credit system. There are other avenues for co-operation, as, for example, in the matter of several adjoining growers on the one telephone-line combining to purchase one alarm between them. This would be placed in the coldest of these orchards, a fact which would have been previously ascertained by taking a series of temperatures. Members of the group could then help each other in lighting and managing the fires.

In view of the probable early establishment of a climatological station at Alexandra, and subsequently, it is hoped, the stationing of a scientific investigator here, considerable assistance should be available in forecasting frosts and the amount of heating required to combat them.

(To be continued.)

COMMON AILMENTS OF LIVE-STOCK AND THEIR TREATMENT.

(Continued.)

J. LYONS, M.R.C.V.S., Director, Live-stock Division, Wellington.

Contagious Abortion.

THIS is a specific disease caused by a bacillus which sets up a catarrhal condition of the lining of the uterus recognized by the expulsion of the fœtus at any time during the period of gestation.

The principal source of infection is through the alimentary tract and blood-stream, or the organism may gain entrance through the vagina per medium of the bull or through the female's hindquarters coming in contact with infectious material. When the infection reaches the uterus slow catarrhal inflammation is set up, which gradually separates the placenta or cleansing from its attachments. As the process proceeds the fœtus is gradually deprived of nourishment, and is ultimately expelled as a foreign body. This may occur at almost any period during gestation, but most commonly takes place between the fifth and seventh months. The disease can be spread to certain other animals by inoculation, but is seen to the greatest extent among dairy cows. The ravages of the disease are felt throughout New Zealand, and in this respect we do not stand alone, as its effects are widespread in every other civilized country where dairying is carried on.

A feature of the disease is the extreme virulence shown when it first appears in a clean herd—any number up to 50 per cent. may abort. In each succeeding season the number of cases diminishes, until ultimately few are experienced, provided the farmer has been breeding his own stock and no fresh animals have been introduced. This is due to the fact that owing to the presence of the infection in the system a certain amount of immunity has been conferred. This is the stage at which the majority of our herds in New Zealand have arrived, as proved by the fact that the number of cases seen in any given herd is nothing like so great as was the case fifteen to twenty years ago. There are still exceptions, and the disease is still liable to be seen in a virulent form where the germ gains a footing in a clean herd.

In a pastoral country such as ours, where the herds range on pasture all the year round, the risk of infection and difficulty of control are greater than where the animals are housed for a considerable part of the year. In the latter case the cows are for the most part calved indoors, and the discharge after calving can be controlled and dealt with, thereby saving the pastures from contamination. It must be remembered that once a cow has aborted she remains a carrier of the disease more or less for the remainder of her existence, and, although she may carry her calf for the full time at each succeeding calving, being still a carrier she is spreading infection during each calving-period.

It will thus be seen that the matter of preventing the spread of fresh infection is a somewhat difficult one—in fact, it is almost impossible unless the owner is prepared to subject all animals in the herd to the agglutination test, separate the infected animals from the

non-infected, and run the herd in two different sections. Even then it would be necessary to see that the non-infected cows were placed on paddocks free from infection, and that hay or ensilage from land on which affected cows had been grazed before the material had been cut was not fed to the clean herd. Owing to the difficulties of segregation most owners prefer to take the risk of a few cows slipping each year. At the same time every effort should be made to lessen the risk of infection and far as possible keep it within bounds.

Symptoms.—There are no general constitutional symptoms in abortion disease, the general health of the animal remaining unimpaired throughout. If the animal is under observation preparatory symptoms will be seen, in some cases a few weeks but more frequently only for a few days, before the act takes place. Those seen in approaching parturition consist of swelling of the vulva, slackening of the pelvic ligaments on each side of the tail, and tension of the udder and teats. If the animal is in milk, curds and even blood may be noticed in the secretion, giving it the appearance of colostrum or beastings. In cases where the udder is not in active secretion milk can be observed in the gland. There is also a discharge of yellow gelatinous material from the vulva, and later uneasiness or slight straining may occur. If abortion takes place in the early period of gestation these symptoms are absent, the fœtus being expelled in its membranes; and the first indication of what has taken place consists in the animal showing signs of returning to the bull.

When an animal aborts the afterbirth is retained usually for a few days, but in a few instances it may remain for weeks until it comes away in shreds. If the afterbirth is seen, at those parts where it has been attached to the womb a thick gelatinous, purulent material will be observed, and the same material is also attached to the womb. This exudes as a yellow purulent material which later turns to a brownish watery discharge. This discharge is highly infectious, and every effort should be made to see that it is not spread all over the farm by infected animals and thus become a source of further infection.

Prevention and Treatment consist in isolation. As soon as an animal shows signs of abortion she should be placed in a paddock reserved for this purpose and kept by herself. After the act the fœtus should be burned or buried, and any membranes which come away should be treated similarly and not allowed to lie for dogs to carry about the premises. For the first few days the womb should be irrigated daily with a mild antiseptic solution, or pessaries may be used, after which, and before the animal is allowed to run with the rest of the herd, irrigation should be done at intervals until the discharge disappears. Such an animal should not be put to the bull for at least two and a half to three months after the date of abortion. All aborted cows in the herd should be treated similarly, and the paddocks should afterwards be hard grazed with sheep or with dry cattle intended for fattening. If these measures are strictly observed it will go a long way toward preventing the spread of further infection.

It must also be remembered that when the womb is inactive the abortion bacilli migrate to the udder and are secreted with the milk. This when fed to calves, although it does not affect them permanently,

passes through their digestive tract and may be a source of infection to other pregnant animals.

As a means of controlling the disease vaccines—both live and dead cultures—have been tried, but so far without affording relief. Experience in this respect shows that dead cultures are incapable of promoting either preventive or curative action, while although living cultures may confer some immunity their use is prohibited by the fact that they are absolutely dangerous, inasmuch as they may be an active agent in introducing the disease. Investigation and research into abortion disease has so far not given us a practical means of control, and in the light of our present experience we have still to depend on preventive measures.

Retention of the Afterbirth or Cleansing.

This is a condition which is frequently seen among our dairy herds during early spring, and forms a source of annoyance and indirect loss to the dairy-farmer. It is seldom seen among herds that are properly cared for and receive sufficient food to bring them to the calving season in good condition. But in herds that are allowed to become low in condition before calving, the trouble at times almost assumes epidemic proportions. Under such conditions the womb lacks sufficient tone to expel the membranes, with the result that it comes away in shreds. The toxins arising through putrefaction are absorbed into the system, which still further lowers the animal's vitality, and it may be months before she is fit to give her best if she ever does that season. It is difficult to estimate the loss from this cause, but in the aggregate it must be very considerable.

Retention of the afterbirth also occurs after abortion. In both cases it is lack of tone in the muscular coat of the womb which prevents that organ from contracting, a condition that must be present if the membrane is to be expelled.

The period at which the cleansing should be taken away varies in different subjects. On no account, however, should it be forcibly extracted, as under such conditions the results frequently prove disastrous. If on insertion of the hand and arm it is found that the cleansing adheres firmly, it should be left alone until it is less adherent. Before removal is attempted it is good practice to thoroughly cleanse the hands and arms in an antiseptic solution. The womb should then be douched with 1½ to 2 gallons of warm water to which an antiseptic such as lysol or Jeyes fluid has been added. The hand should then be introduced and the membranes gently stripped from their attachment; this is a somewhat tedious process, but when the membranes are disattached at a few centres a little further manipulation and traction is all that is necessary to bring the whole thing away.

The method just described cannot be practised by the every-day attendant, and should be left to those whose experience fits them to undertake the operation. A handy and safer method for the ordinary attendant is as follows: After the womb has been douched the visible membranes should be caught and twisted into a rope after raising them from the floor of the passage, and gentle traction applied. If it is

found that progress is being made the attempt should be continued; if not, the attendant should desist and resume the operation later on. In this manner the afterbirth can often be removed without any serious inconvenience to the animal.

One often meets with persons who have implicit faith in certain drenches as an aid to removal of the afterbirth. Such faith, however, is without foundation, as there is no medicine or combination of them that will bring about the desired effect. Nevertheless medicines have their uses under such conditions. It should be remembered that in cases of this kind toxins are more or less absorbed through the flaccid womb, and these act as a poison in the system. By keeping the bowels open the animal is enabled to get rid of this poison through the digestive tract. As a drench for this purpose nothing answers better than Epsom salts, ¾ lb. to 1 lb.; ground ginger, 1 oz.; and nux vomica, 2 drams—given in a quart of water or thin gruel. Hyposulphite of soda, 2 oz. to 3 oz.; ginger, 1 oz.; and nux vomica, 2 drams—given in the same way—also has a beneficial effect.

Septic Metritis (Inflammation of the Womb).

This trouble is generally met with as a sequel to retention of the cleansing, or it may occur without that condition being present, in which case the predisposing cause is an injury to the organ during parturition or clots of blood retained therein. It may occur, however, when none of these conditions is present, the casual organism being carried through the soiled hands or instruments of the attendant. The disease is not due to any specific organism, rather it is the result of a mixed infection. It is essentially a toxæmia accompanied by inflammation, the result of which frequently proves fatal, and if successful results are to follow treatment the disease must be diagnosed in its early stages. The trouble usually makes its appearance from two to five days after parturition, the symptoms varying according to the intensity of the inflammation.

Symptoms.—One of the earlier symptoms noted is general disturbance of the system, frequently introduced by rigours. Rumination is suspended; fever is indicated by rise in temperature; breathing is quick and shallow; the mucous membranes are highly infected; the pulse is rapid and weak; the appetite is entirely gone; and the secretion of milk almost ceases. At the onset of the attack constipation is present which soon gives place to diarrhœa fetid and dark in colour. The animal shows pronounced stiffness, especially of the hind quarters, and knuckles over on the hind fetlocks; when walking it frequently staggers. An anxious expression is present, the legs drawn together, and the head held low. If the animal is housed a peculiar odour exudes from the body, and in the later stages emphysamatous conditions are seen beneath the skin. Straining is frequently present, and a discharge of chocolate-coloured material exudes from the vulva.

Treatment.—The animal should be made as comfortable as possible with suitable warm clothing, and the womb douched frequently with warm water to which an antiseptic such as Jeyes fluid has been added. Owing to the loose state of the bowels a purgative is not indicated, but considerable benefit will be derived by dosing the animal every

three or four hours with a mixture of hyposulphite of soda, 1 oz. to 1½ oz., and nux vomica, 2 drams, given in oatmeal gruel. The appetite should be encouraged by giving anything the patient fancies, in small quantities.

(To be continued.)

TESTING OF FRUIT-TREE STOCKS.

J. A. CAMPBELL, Director, Horticulture Division.

THE stocks on which fruit-trees are worked have an important bearing on crop results, and consequently this is a matter of vital concern to commercial fruitgrowers.

The Northern Spy stock at present generally used for apple-trees in New Zealand has the advantage of being immune to aphis attack, which was very troublesome previously. It also has the advantage of bringing trees into bearing at an early date. However, the trees remain comparatively dwarf on many classes of land, and growers desire a stock with a more vigorous influence. They point to trees on the same land bearing two or three times more fruit than the average tree on the Spy stock. Tests are being carried out by the Horticulture Division with a number of likely stocks, with a view to obtaining this vigour permanently without losing the advantages the Spy stock affords.

The apricot and cherry trees which form such an important feature of the fruitgrowing industry of Central Otago are growing on sundry and unknown stocks, many of these being very unsatisfactory. With a view to more exact knowledge, and to ascertain the best stocks for these trees under the special local conditions, all reputable stocks are now being tested for purposes of comparison.

The lemon and orange groves of Auckland Province are in a somewhat similar position; stocks suitable in other countries are not always suitable for local conditions. For instance, lemons on their own roots are popular in New South Wales, but in this country they are generally short-lived. The tests being carried out at Tauranga indicate that a vigorous lasting stock can be obtained for this purpose. They are also proving that a stock popular with some nurserymen is useless on most soils, and will compel a discontinuance of its use.

While in England last year Dr. C. J. Reakes, Director-General of Agriculture, and Mr. T. Rigg, of the Cawthron Institute, both visited the East Malling Experimental Station in Kent, and obtained much useful information on the work being carried out there in connection with fruit-tree stocks. Dr. Reakes also discussed means whereby the Horticulture Division would in future be kept in closer touch with this work through co-operation in activities.

COPPER CARBONATE DUST TREATMENT FOR SEED WHEAT.

OTAGO FARMERS' EXPERIENCE.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin.

DURING the autumn of 1927 the use of copper carbonate dust for the control of stinking-smut (*Tilletia Tritici*) was introduced in a practical way to the wheat-growers of Otago by the treatment of small lines of their seed wheat by the Fields Division. In all some 2,130 bushels were treated. The bulk of this was done at a central depot in Oamaru, Messrs. Dalgety and Co. kindly giving the use of their grain-store for this purpose. Detailed experimental work was not carried out, but many of the farmers grew the copper carbonate treated seed alongside that treated with bluestone (copper sulphate) or formalin. Thus they were able to obtain a fair comparison of the treatments under general farming conditions.

Later in the year each farmer concerned was invited, by means of a questionnaire, to present his estimation of the copper carbonate treatment: Fully 90 per cent. acknowledged the superiority of this treatment over either bluestone or formalin after all factors had been considered. This contention is well supported by data obtained from carefully conducted experiments by the Department.

On analysing the questionnaires it is found that of the farmers who compared copper carbonate dusted seed with formalin treated seed 60 per cent. acknowledged a higher germination percentage, while 40 per cent. are of the opinion it was on the same plane in this respect. Fifty-five per cent. state that the dusted wheat germinated much quicker, while 45 per cent. state they could not notice any appreciable difference in this respect.

Of those who compared the dusted seed with bluestone 59 per cent. acknowledge a higher germination percentage, while 35 per cent. state the germination percentage to be the same; 6 per cent. state it was lower. Fifty-nine per cent. state it germinated much quicker, while the remainder state they could not recognize any great difference.

In no instance was the appearance of stinking-smut reported, and no trace of this disease could be found in the copper carbonate treated crops that were caiefully inspected. Loose smut (*Ustilago Tritici*) was noticed in varying degrees of intensiveness, but it must be remembered that pickling with either formalin, bluestone, or copper carbonate does not control this disease.

The consensus of opinion is decidedly in favour of the dry method of pickling. A large proportion of the questionnaires were prefaced with remarks which should be convincing to those farmers who feel diffident about using this method. The following are typical examples: "We find it much easier to sow the seed; better and quicker germination; and the saving of half a bushel of seed per acre." "I have used copper carbonate for two seasons, and find a much stronger,

thicker, and more healthy and vigorous braid." "Came away a lot brighter-looking and quicker than the formalin; was very pleased with the result."

Copper carbonate treatment is not claimed to be more efficacious than either bluestone or formalin for the control of smut, but it has certain advantages which recommend it in preference to the wet methods. The usual formaldehyde or bluestone treatment generally causes some damage to the seed, and also reduces the promptness of germination and vigour of the seedlings to an appreciable extent, particularly when the soil temperature and moisture conditions are not favourable to quick germination. To lose up to 30 per cent. or more of the stand from liquid-treatment injury, especially when the solution has not been accurately prepared, is not uncommon, and this fact is not always sufficiently realized by wheat-growers.

Copper carbonate causes no injury to seed or seedlings. The grain comes up more promptly, and shows as a rule greater vigour than with liquid treatments. The treatment can be applied months ahead, if desired, with no ill effect to the seed during storage. The dry treatment is less troublesome to carry out, since no solutions of correct strength need be made up. The dust is generally applied at the rate of 2 oz. per bushel, but should this amount be exceeded by accident or otherwise no fear of damage to the seed need be entertained. As it has been definitely proved that copper carbonate dust does not lower the germination capacity or hamper the seedlings, farmers can safely lower their rate of seeding without fear of the resultant crop being thinner than usual.

A useful facility for our wheat-growers would be originated by seed-merchants attaching dusting-machines to their wheat-grading plants and adhering to the proposal that only graded wheat be treated. Undoubtedly many farmers would avail themselves of the opportunity of purchasing treated seed rather than treat it themselves, and by so doing a much larger acreage of graded seed would be sown than at present. The practice would thus be one of the contributing agencies for steadily improving the quality and prolificacy of our wheat crops.

INTRODUCTION OF MULBERRY VARIETIES.

ITALIAN settlers in Nelson District recently sought the assistance of the Department of Agriculture to introduce improved varieties of mulberry-trees for the raising of silkworms. These people have a good knowledge of sericulture, and have already taken it up here as a domestic sideline to their main activities of fruit-, tomato-, and tobacco-growing. The Department therefore readily took action to procure the desired stock from Italy. A supply of young trees of some half-dozen different varieties was received last month in excellent condition (through our High Commissioner in London) from a leading nursery firm in the Province of Venetia. The trees have been distributed to the best advantage, and may be expected to be increased by propagation in due course. It is considered that sericulture may also prove a sideline for other settlers in suitable districts.

BRAXY-LIKE DISEASE AND FLUKE IN SHEEP.

SUCCESSFUL CONTROL WORK REPORTED FROM HAWKE'S BAY.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

IT is very satisfactory to learn from the latest field report made by the Department's Veterinarian stationed at Hastings, Mr. E. E. Elphick, that those farmers who have diligently attempted to overcome the liver-fluke parasite, and consequentially the braxy-like disease affecting sheep in the fluke-affected area, have this season experienced a very small mortality. Many farmers, on the other hand, who have not been able to drain their swamps, dress with copper sulphate, or drench their sheep in this effort to control the fluke have already had considerable losses. The fact that the braxy-like disease has been so easily controlled by ridding the farm of liver-fluke is proof of the correctness of the view advanced in the *Journal* for September last that the fluke is the carrier of the disease organism into the liver.

A successful trial in lowering the expense of treating sheep for the adult fluke has recently been made on a large Hawke's Bay sheep-station with a mixture of paraffin oil (4 parts) and carbon tetrachloride (1 part). This mixture of oil and drug, which is easy to administer, as well as cheap, may be procured in 1-gallon tins at a cost of 15s. per gallon, this amount being sufficient for 800 sheep. It is necessary to buy one or two 5 c.c. syringes, without hypodermic needles. Among others, the Record pattern (price 12s. 6d.) may be recommended. Both ready-mixed drug and syringe can be obtained from Kempthorne, Prosser, Ltd., Wellington, at the prices mentioned.

An easy and safe method of drenching is to obtain a strong drenching-funnel and to squirt the syringeful of mixture into the mouth of the sheep through the funnel. This procedure protects the barrel of the syringe from injury, and also does not tire the hands of the operator to the same extent as when opening the mouth of each sheep forcibly by hand. With two men catching the sheep, and another holding a cup of the mixture, one operator can easily drench 1,000 sheep per day, and make sure that each sheep gets its full supply. With the capsule method of administration there is a possibility of the sheep dropping the dose before swallowing.

Any further particulars required may be obtained from the Veterinarian, Department of Agriculture, Hastings, Hawke's Bay.

INTERIM RETURNS OF LIVE-STOCK.

INTERIM returns of live-stock in the Dominion for the season 1927–28, issued by the Census and Statistics Office, show the following position as regards the leading items (final figures for 1926–27 being added in parentheses) :—Dairy cows, 1,312,126 (1,303,225); total cattle, including dairy cows, 3,202,724 (3,257,729); horses, 299,112 (303,713); pigs, 567,874 (520,143); sheep shorn, 24,500,731 (23,441,808); lambs tailed, 13,484,243 (12,069,681); total sheep, 30th April, 1928, 27,001,236 (25,649,016). Full particulars of the interim sheep return are given elsewhere in this issue.

PASTURE TOP-DRESSING EXPERIMENTS IN OTAGO, SEASON 1927–28.

(Concluded.)

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South Otago.

IN South Otago sixteen new plots were laid down, in addition to three which had been established during the season of 1926–27, thus making a total of nineteen plots well distributed throughout the southern portion of the province. These experiments were the last of the series laid down, consequently all applications of fertilizers were made at what can be considered a late date. As was expected, a number of the plots showed no increase from lime, and very small increases from the various fertilizers. In perusing the results here presented the lateness of application must be constantly kept in mind. Fortunately, the experiments are intended to cover a period of four years, and it may be confidently expected that the effect of late top-dressing this year will be compensated for by next year's weighings.

The results of the plots laid down during season 1927–28 are recorded hereunder. The two-year results of the three plots laid down in season 1926–27 will be dealt with in a separate article.

(23) COCKBURN BROS., TE HOUKA.

This pasture situated on the banks of the Molyneux (Clutha) River had been sown down in 1922 with a mixture of timothy and clovers, but had not been top-dressed. At the time that the present experiment was laid down it had run mostly to inferior grasses, clover being hardly noticeable. The plot was top-dressed on 2nd September, 1927, closed to stock on 25th October, and harvested 4th January, 1928. Results are shown in the following table :—

Table 18.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag	41·6	S	1 16 1	9 1 3	0 15 0	0 8 9 (gain)
30	Basic slag and lime	42·0	S	1 16 3	9 3 9	1 8 0	0 1 9 (loss)
30	Super	52·8	S	2 6 1	11 11 3	1 1 0	2 12 9 (gain)
30	Super and lime ..	56·0	S	2 9 0	12 5 0	1 14 0	2 13 6 (gain)
35	Lime	38·0	N	1 13 1	8 6 3	0 13 0	0 4 3 (loss)
...	Control ..	36·4	..	1 11 2	7 17 6	..	..

Summary: Superphosphate and lime gave the best results on this plot, with super alone not very much lower. The clover-growth on these strips was very marked. Basic slag showed a slight increase, but

had not the clover content of the superphosphate strips. Lime alone gave a very slight increase over the control.

(24) G. L. CUNNINGHAM, HILLEND.

This plot is situated on the rolling country towards Awamangu, and had been sown down in the winter of 1921 with rape, a mixture of rye-grass, cocksfoot, crested dogstail, and clovers. The plot was top-dressed in 1924 with ½ cwt. of Nauru phosphate, and ½ cwt. superphosphate per acre. In the spring of 1927, when the experiment was commenced, the pasture had run practically to brown-top. The plot was top-dressed on 7th August, 1927, closed to stock on 25th October, and harvested on 6th January, 1928. Results are tabulated below.

Table 19.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	12·9	N	0 11 1	2 16 3	0 15 0	0 8 9 (loss)
30	Basic slag and lime	12·7	N	0 11 0	2 15 0	1 8 0	1 3 0 (loss)
30	Super	12·7	N	0 11 0	2 15 0	1 1 0	0 16 0 (loss)
30	Super and lime ..	12·6	N	0 11 0	2 15 0	1 14 0	1 9 0 (loss)
40	Lime	12·2	N	0 10 2	2 12 6	0 13 0	0 10 6 (loss)
..	Control ..	11·6	..	0 10 0	2 10 0	..	..

Summary: An examination of these results reveals the fact that there is no apparent increase due to any manure or mixture of manures that had been applied. A close inspection of the superphosphate and basic-slag strips showed that there was a semblance of clovers coming in, which will more than likely make more interesting results in the subsequent years of the experiment.

(25) A. AND A. CRAIG, GREENFIELD.

The pasture selected for this experiment is situated on rolling country somewhat akin to that of the preceding test, and had been sown down some considerable time with the usual grass and clover mixture. At the date of top-dressing it had run out very badly to sweet vernal and crested dogstail, there being a dearth of clover growth. The plot was top-dressed on 5th September, 1927, closed to stock on 25th October, and harvested on 6th January, 1928. Results are presented in Table 20 (next page).

Summary: No very marked differences were observed during the growing-period. When harvesting the plot a slight increase in the superphosphate weighing was observed, which was due to the increase in clover-growth. The effect of lime in conjunction with super or basic slag made no apparent change, while lime alone showed little more than the control on this year's results. Owing to the lateness

Table 20.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	16·4	N	0 14 1	3 11 3	0 15 0	0 3 9 (loss)
30	Basic slag and lime	15·73	N	0 13 3	3 8 9	1 8 0	0 19 3 (loss)
24	Super	17·2	N	0 15 0	3 15 0	1 1 0	0 6 0 (loss)
24	Super and lime ..	15·1	N	0 13 0	3 5 0	1 14 0	1 9 0 (loss)
30	Lime	13·9	N	0 12 1	3 1 3	0 13 0	0 11 9 (loss)
..	Control ..	13·6	..	0 12 0	3 0 0	..	..

of the season when the plot was top-dressed, this is not surprising. It is anticipated that definite increases will be observed next season.

(26) V. WILSON, GREENFIELD.

This plot, situated on the light flat country at Woodend, had been sown down in 1920 with rye-grass, cocksfoot, and white clover. At the time of top-dressing the pasture was in a very poor state, having gone back to Yorkshire fog, sweet vernal, and weeds, with a little cocksfoot still persisting. The plot was top-dressed on 6th September, 1927, closed to stock on 25th October, and harvested on 7th January, 1928. Results were as follows :—

Table 21.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
24	Basic slag ..	18·1	N	0 15 3	3 18 9	0 15 0	0 13 9 (loss)
24	Basic slag and lime	18·8	N	0 16 2	4 2 6	1 8 0	1 3 0 (loss)
24	Super	20·8	N	0 18 1	4 11 3	1 1 0	0 7 3 (loss)
24	Super and lime ..	21·1	N	0 18 2	4 12 6	1 14 0	0 19 0 (loss)
32	Lime	18·0	N	0 15 3	3 18 9	0 13 0	0 11 9 (loss)
..	Control ..	17·8	..	0 15 2	3 17 6	..	..

Summary: So far no significant increases in weight have been obtained from the weighings of this plot. The fact is to be recorded, however, that in those strips top-dressed with superphosphate alone, and super in conjunction with lime, slightly heavier weighings were obtained, the difference being due largely to an increased clover content in the strips thus treated. Lime showed no apparent improvement, nor could it be reasonably expected to do so when the lateness of its application is borne in mind.

(27) C. BODY, KELSO.

The pasture on which this experiment was carried out is situated on the foothill country adjacent to Kelso. Sown down in 1924 with rye-grass, crested dogstail, and white clover, at the time of top-dressing it had deteriorated, being more or less open and occupied with weeds such as epilobium, which was very much in evidence. Crested dogstail held to a certain extent, while Yorkshire fog was very profuse. The plot was top-dressed on 12th September, 1927, closed to stock on 18th October, and harvested on 11th January, 1928. Following are the results :—

Table 22.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
20	Basic slag	23·0	N	1 0 0	5 0 0	0 15 0	..
20	Basic slag and lime	24·1	S	1 1 0	5 5 0	1 8 0	0 8 0 (loss)
30	Super	24·2	S	1 1 1	5 5 0	1 1 0	0 1 0 (loss)
30	Super and lime ..	24·3	S	1 1 1	5 6 3	1 14 0	0 12 9 (loss)
30	Lime	21·8	N	0 19 0	4 15 0	0 13 0	0 3 0 (loss)
..	Control ..	19·5	..	0 17 0	4 5 0	..	..

Summary: The variation of the effects of the different manures used on this plot was very slight. Although both fertilizers used showed an increase over the control plot, the application of lime did not tend to increase that yield. Lime alone showed a slight increase over the unlimed portion.

(28) S. OTTREY, HERIOT.

The pasture used for this trial is situated on rolling country, the soil being of a light texture, and had been sown down with rye-grass, timothy, and white clover. At the time of top-dressing the pasture was of a very open nature, due to some extent to the ravages of the

Table 23.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
24	Basic slag ..	13·1	N	0 11 1	2 16 3	0 15 0	0 13 9 (loss)
24	Basic slag and lime	13·6	N	0 11 3	2 18 9	1 8 0	1 4 3 (loss)
30	Super	14·3	N	0 12 2	3 2 6	1 1 0	0 13 6 (loss)
30	Super and lime ..	14·4	N	0 12 2	3 2 6	1 14 0	1 6 6 (loss)
30	Lime	13·7	N	0 11 3	2 18 9	0 13 0	0 9 3 (loss)
..	Control ..	12·8	..	0 11 0	2 15 0	..	..

grass-grub. Weeds were taking possession of the bare patches, while the rye-grass was of a very spindly character. The plot was top-dressed on 13th September, 1927, closed to stock on 18th October, and harvested on 13th January, 1928. Results are shown in Table 23.

Summary: The results were unsatisfactory. Very little growth had taken place, as is borne out by the small weighings. There was little or no clover in the control or basic-slag strips, while the superphosphate strips showed just a semblance of white clover.

(29) J. COTTON, BELLAMY, EVANS FLAT.

Sown down in 1920 with rye-grass, crested dogstail, and clover, this pasture had at the time of top-dressing run to brown-top. The plot is situated on rising ground of a light nature. It was top-dressed on 14th September, 1927, closed to stock on 18th October, and harvested on 16th January, 1928. Results were as under:—

Table 24.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.		
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.
30	Basic slag ..	7·0	N	0	6	1	1	11	3	0	15	0	0	10	0 (loss)
30	Basic slag and lime	7·1	N	0	6	1	1	11	3	1	8	0	1	3	0 (loss)
30	Super	9·1	N	0	8	0	2	0	0	1	1	0	0	7	3 (loss)
30	Super and lime ..	7·5	N	0	6	2	1	12	6	1	14	0	1	7	9 (loss)
35	Lime	6·8	N	0	5	3	1	8	9	0	13	0	0	10	6 (loss)
..	Control ..	6·1	..	0	5	1	1	6	3	..					..

Summary: This is one of the plots with which the estimation of results by weighing does not do justice to the effect of the manures. Although there is comparatively no difference in the weighings, there was a vast difference in the composition of the strips. The growth was small, but on the superphosphate strips white clover was coming in to a marked extent.

(30) A. TWEED, MONEYMORE.

This pasture had been sown down in 1925 with rye-grass, crested dogstail, clover, and alsike, and at the time of top-dressing it was in quite good condition. The rye-grass was perhaps not so vigorous as might have been expected, but, except for the presence of some Yorkshire fog, the pasture was in ideal condition for trying the effects of the various manures. The plot was top-dressed on 31st August, 1927, closed to stock on 1st November, and harvested on 17th January, 1928. Table 25 presents the results.

Summary: Considering the high fertility of this pasture when top-dressed, the results were an indication of the increased growth that can be obtained from judicious top-dressing. All manures used, also

Table 25.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.			
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.	
30	Basic slag ..	31·3	S	1	7	1	6	16	3	0	15	0	0	6	3	(gain)
30	Basic slag and lime	33·8	S	1	9	2	7	7	6	1	8	0	0	4	6	(gain)
30	Super	33·95	S	1	9	3	7	8	9	1	1	0	0	12	9	(gain)
30	Super and lime ..	35·0	S	1	10	2	7	12	6	1	14	0	0	3	6	(gain)
40	Lime	28·5	N	1	4	3	6	3	9	0	13	0	0	4	3	(loss)
..	Control ..	26·4	..	1	3	0	5	15	0		..					..

lime gave a response, but the highest yield was obtained from superphosphate plus lime. Super alone, on this year's results, was the most payable proposition. Basic slag, with and without lime, also gave definite increases over the control plots. Clover-growth in each case was responsible for the increased weights.

(31) D. McG. REID, MARAPUNA, MILTON.

This plot is located on the Tokomairoro Plain, at Milton. The pasture had been laid down in 1924, the grasses used being perennial and Italian rye-grass, cocksfoot, and clovers. At the time of top-dressing the pasture was chiefly composed of cocksfoot and some of the minor grasses and white clover. The plot was top-dressed on 31st August, 1927, closed to stock on 1st November, and harvested on 17th January, 1928, with the following results:—

Table 26.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.			
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.	
30	Basic slag ..	31·6	S	1	7	3	6	18	9	0	15	0	0	13	9	(gain)
30	Basic slag and lime	41·2	S	1	16	0	9	0	0	1	8	0	2	2	0	(gain)
30	Super	36·4	S	1	11	3	7	18	9	1	1	0	1	7	9	(gain)
30	Super and lime ..	43·3	S	1	17	3	9	8	9	1	14	0	2	4	9	(gain)
30	Lime	30·2	S	1	6	1	6	11	3	0	13	0	0	8	3	(gain)
..	Control ..	24·5	..	1	2	0	5	10	0		..					..

Summary: In all instances there was a decided increase over the unmanured plots. Lime alone, and used in conjunction with both super and basic slag, has shown up remarkably well, considering the fact that the lime was applied in the form of carbonate. Super and lime gave the greatest response, while basic slag and lime came next. Super gave a far higher yield than basic slag, which itself had a marked

increase over the control plot. The cocksfoot in the manured strips, together with increased clover-growth, were responsible for the increased yields.

(32) W. B. PATERSON, STUART DOWNS.

The pasture on which this trial was conducted is situated on the hill country near Creighton. The pasture had been sown down in 1923 with rye-grass, crested dogstail, and clover. At the time of top-dressing the paddock had deteriorated to such an extent that practically none of the original grasses remained, and to all intents and purposes it could be looked on as a brown-top and sweet vernal pasture devoid of clovers. The plot was top-dressed on 1st September, 1927, closed to stock on 1st November, and harvested on 18th January, 1928. Results are tabulated below :—

Table 27.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.			Value of Hay per Acre.			Cost of Manure per Acre.			Profit or Loss compared with Unmanured Plot.			
		lb.		T.	cwt.	qr.	£	s.	d.	£	s.	d.	£	s.	d.	
24	Basic slag ..	4·9	N	0	4	1	1	1	3	0	15	0	0	15	0	(loss)
24	Basic slag and lime	5·4	N	0	4	2	1	2	6	1	8	0	1	6	9	(loss)
30	Super	6·6	N	0	5	3	1	8	9	1	1	0	0	13	6	(loss)
30	Super and lime ..	7·1	N	0	6	1	1	11	3	1	14	0	1	4	0	(loss)
30	Lime	5·4	N	0	4	2	1	2	6	0	13	0	0	11	9	(loss)
..	Control ..	4·8	..	0	4	1	1	1	3		..			..		

Summary: As in the case of J. Cotton's plot, at Bellamy, only small weighings could be obtained, and little information can be gleaned from the actual figures. There was practically no difference between the unmanured and manured strips at the time of harvesting, and there was no visible indication at that time to differentiate between the superphosphate and the basic-slag strips. But at the beginning of April, on the aftermath, the clover content of the superphosphate and basic-slag strips was quite distinct. Second year's results in such a case ought to be more favourable to the manured plots.

(33) R. KINNARD, MAUNGATUA.

Situated on the Taieri Plain, near Maungatua, this pasture had been sown down in 1920 with a mixture of rye-grass and clovers. At the time of top-dressing it was in fair condition, a good sole of grass and clover prevailing throughout. The paddock was top-dressed on 22nd July, 1927, closed to stock on 1st November, and harvested on 18th January, 1928. Table 28 gives results.

Summary: Excellent results were obtained from the fertilizers used. Lime alone gave a good response. The highest yield was obtained from super and lime, although super alone proved a very payable proposition. Basic-slag, with and without lime, showed a decided increase over the

Table 28.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plots
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
24	Basic slag ..	51·9	S	2 5 1	10 11 3	0 15 0	1 0 0 (gain)
24	Basic slag and lime	52·0	S	2 5 1½	10 11 10	1 8 0	0 7 7 (gain)
30	Super	54·8	S	2 7 3	11 18 9	1 1 0	2 1 6 (gain)
30	Super and lime ..	57·9	S	2 10 2	12 12 6	1 14 0	2 2 3 (gain)
35	Lime	46·6	S	2 0 3	10 3 9	0 13 0	0 14 6 (gain)
..	Control ..	40·3	..	1 15 1	8 16 3	..	..

unmanured plots, but although not visible to the eye at the time of harvesting the superphosphate plots proved superior. Clover-growth again was responsible for the increase in weights over the control plots.

(34) J. WITHERS, MAUNGATUA.

The pasture selected for this experiment is situated on the foothills of Maungatua, and had been sown down about the year 1918 with a rye-grass mixture and clovers. At the time of carrying out the trial the paddock had lost most of the rye-grass—cocksfoot, sweet vernal, and Yorkshire fog being the dominant grasses—while clover was barely visible. The plot was top-dressed on 21st July, 1927, closed to stock on 1st November, and harvested on 19th January, 1928. Results were as follows:—

Table 29.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	29·3	S	1 5 2	6 7 6	0 15 0	0 13 9 (gain
30	Basic slag and lime	29·8	S	1 6 0	6 10 0	1 8 0	0 3 3 (gain
30	Super	31·0	S	1 7 0	6 15 0	1 1 0	0 15 3 (gain)
30	Super and lime ..	29·6	S	1 5 3	6 8 9	1 14 0	0 4 0 (loss)
36	Lime	22·9	N	1 0 0	5 0 0	0 13 0	0 11 9 (loss)
..	Control ..	22·6	..	0 19 3	4 18 9	..	..

Summary: The superphosphate strips on this plot were clearly visible prior to cutting, due to the presence of white clover, and this fact reflected itself in the weighings. The application of lime on this season's growth was negligible. Basic slag, with and without lime, showed an increase over the control, but the differences were not so noticeable as on the superphosphate strips.

(35) A. J. SPENCER, BERWICK.

This plot, established on the Taieri Plain adjacent to the contour channel near Berwick, had been sown down about the year 1921 with a mixture of rye-grass, cocksfoot, timothy, alsike, and white clover. At the time of laying down the experiment the rye-grass had practically run out—some inferior grasses replacing it—while the clover content was very sparse. The plot was top-dressed on 29th August, 1927, closed to stock on 1st November, and harvested on 20th January, 1928. Following are results:—

Table 30.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plots
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
30	Basic slag ..	47·9	S	2 1 3	10 8 9	0 15 0	1 11 3 (gain)
30	Basic slag and lime	44·2	S	1 18 2	9 12 6	1 8 0	0 2 0 (gain)
30	Super	50·7	S	2 4 1	11 1 3	1 1 0	1 17 9 (gain)
35	Super and lime ..	51·2	S	2 4 3	11 3 9	1 14 0	1 7 3 (gain)
40	Lime	37·9	N	1 13 0	8 5 0	0 13 0	0 10 6 (loss)
..	Control ..	37·2	..	1 12 2	8 2 6	..	..

Summary: Fairly high weighings were recorded as the result of this trial. Superphosphate and super plus lime gave the greatest response. These strips were clearly defined by the presence of white clover and the abundance of alsike. Although basic slag, with and without lime, gave a considerable increase over the control plots, the type of herbage was not the same as that on the superphosphate strips. Lime alone did not give a response.

(36) MAJOR HICKEY, WAIPAHI.

This plot, situated on hill country adjacent to Waipahi, had been sown down in 1922 with a mixture of rye-grass, cocksfoot, dogstail, timothy, clovers, and trefoils. At the time of top-dressing the pasture had deteriorated considerably, and consequently inferior grasses had taken the place of the rye-grass to a great extent, while clovers were practically non-existent. The plot was top-dressed on 21st September, 1927, closed to stock on 25th October, and harvested on 23rd January, 1928, with the following results. Results are shown in Table 31.

Summary: Growth was very meagre on this plot, the weighings being consequently very small. Superphosphate, with and without lime, gave nearly twice the return of the unmanured plot, due largely to the growth of suckling clover, very little white clover being present. The basic slag and basic slag with lime strips did not show up to an appreciable extent, and lime alone gave a negligible increase. The results of this first year's trial cannot be regarded with satisfaction. Even in view of the increases recorded by careful weighings, it was quite evident that the application of either of the fertilizers, when considered on this year's results, was not encouraging.

Table 31.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
		lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
20	Basic slag ..	9·9	N	0 8 3	2 3 9	0 15 0	0 2 6 (loss)
20	Basic slag and lime	11·6	N	0 10 0	2 10 0	1 8 0	0 9 3 (loss)
20	Super	12·3	S	0 10 3	2 13 9	1 1 0	0 1 6 (gain)
20	Super and lime ..	13·4	S	0 11 3	2 18 9	1 14 0	0 6 6 (loss)
24	Lime	7·7	N	0 6 3	1 13 9	0 13 0	0 10 6 (loss)
..	Control ..	7·1	..	0 6 1	1 11 3	..	..

(37) R. THOMPSON, LAWRENCE.

The pasture on which this experiment was carried out is situated on the high rolling country above Lawrence. The paddock had been sown down about 1906 with a mixture of rye-grass, cocksfoot, and clover, but at the time of top-dressing (14th September, 1927) it had run mainly to brown-top and sweet vernal, with little or no clover. The plot was closed up on the 26th October, 1927, and during the growing-period observations were made, when it was noticed that patches of clover were coming back on the superphosphate strips. Owing to an unforeseen occurrence the plot was not harvested; therefore, treating the test purely from an observational point of view, superphosphate gave the best response. No striking differences due to lime were noted. The basic-slag strips did not show any increase over the control strips. This plot will be closed to stock, and cut and weighed, next season.

(38) J. CLARK, WAIRUNA.

This is a very interesting plot in a brown-top pasture situated on the flat country adjacent to Wairuna Siding. The pasture had been established about 1920 with a mixture of rye-grass, crested dogstail, and white clover. When the experiment was laid down the plot represented practically a straight-out brown-top sward, the clover growth being very weak and scarcely visible. The plot was top-dressed on 8th September, 1927, and closed to stock on 25th October, but was not harvested, so that what no doubt would have been interesting weighings had to be substituted by observations made during the growing-period. The plot was kept under close observation, and from early spring onwards strong clover-growth was noted on the superphosphate strips; slag also gave noticeable results, but not nearly to the same extent as super; crested dogstail also showed up most prominently on the manured strips. Arrangements are being made for the closing-up of this plot next season, when steps will be taken to have it harvested and weighed.

General Summary of Results.

The writers feel diffident in analysing the first year's results of the thirty-eight plots which have been dealt with, owing to the fact that

too hasty conclusions might be drawn by some farmers not conversant with the conditions under which the tests were conducted. It must be stressed that the experiments are only in their first year of operation, and the relative merits of the different fertilizers used must not be gauged on one season's work.

It is interesting, however, to summarize what has occurred during the first season as a result of the application of the various fertilizers. Of a total of thirty-eight plots, thirty-one were carefully weighed and seven were made the subject of close observation (these latter do not enter into the summary). The following points are illuminating :—

(1) In twenty-three plots superphosphate alone gave significant increases.

(2) In only eight plots basic slag alone gave significant increases.

(3) In four plots out of the thirty-one weighed lime gave significant increases.

(4) In twenty-three plots super and lime gave significant increases.

(5) In fifteen plots basic slag and lime gave significant increases.

(6) In eight plots no increase was derived from any treatment.

In the case of eighteen plots out of thirty-one, superphosphate and lime gave the highest yield over all treatments. In the case of five plots superphosphate alone gave the highest yield over all treatments. There is no question that during this first year's trial superphosphate gave the most satisfactory results, whether alone or in conjunction with lime. The differences in weights recorded throughout were invariably due to increases in clover content, and not to increases in general bulk of herbage.

The writers are much indebted to the various farmers who, by willing support and co-operation freely given, have materially assisted in bringing this first year's work to a successful conclusion.

ARROWTOWN FRUIT-TESTING PLOT.

In 1913 a 1-acre co-operative fruit-testing plot was established on Mr. R. M. Patterson's Ayrburn Estate, Lake Hayes, near Arrowtown, in Central Otago, and was planted with a comprehensive selection of stone- and pip-fruit varieties. A recent report on the plot by Mr. W. R. Lloyd Williams, Orchard Instructor for the district, stated that among the apples Delicious, Swaar, Yellow Bellefleur, and Beauty of Bath appeared to be outstanding in vigour and cropping-capacity. Of the plums Lord Kitchener, Grand Duke, and Early Orleans were growing and cropping very well. Among the apricots Early Large Red and Gooley were doing well. The test has now been closed.

—Horticulture Division.

PIRIPIRI CONTROL: AN INSECT PARASITE.

AMONG the weeds the control of which is being studied at the Cawthron Institute piripiri (bidi-bidi) is placed with those of major importance. In the search for suitable insects to control this weed definite progress has been made through the discovery by Brother Claude Joseph, of Temuco, Chile, of a hymenopteron the larvæ of which feed upon the flowers of the Chilian species of *Acaena*.

On behalf of the Noxious Weeds Control Committee of the New Zealand Research Council, Brother Joseph is making a special study of this insect, and it is hoped that a consignment will be soon available for shipment to the Dominion, where it will be studied in quarantine at the Cawthron Institute.

The genus *Acaena*, to which piripiri belongs, is well distributed in Chile, where it is represented by some thirty species; but, though the burrs adhere to wool, the genus has not developed to the same extent as it has in New Zealand, nor is the damage caused by it so widespread. The hymenopteron now in question feeds on more than one species of *Acaena*, but so far is not known to attack any other genus of plants.

—*David Miller, Cawthron Institute, Nelson.*

IMPORTATION AND KEEPING OF WOOL RABBITS.

FOR some time past the question of permitting the importation of Angora and Chinchilla rabbits into New Zealand, and of allowing them to be kept and bred in the Dominion for the purpose of producing their wool for export, has been under official consideration. After going fully into the matter, the Government has decided to permit this under definite conditions, seeing that these rabbits are of a type unlikely to ever become a nuisance, even should any individual animals accidentally obtain their liberty. Moreover, their intrinsic value is sufficient to cause owners to take every precaution to prevent them getting away.

Before any such rabbits may be imported it is necessary to obtain a permit from the Minister of Internal Affairs. It must be clearly understood that such permit will be granted only conditionally on the importer undertaking to keep the animals always in close confinement to the satisfaction of the Government officers concerned, and also to fulfil the conditions laid down as to the procedure to be adopted prior to shipment. This procedure will include the provision of certificates of health, also observance of the precautions necessary to prevent the risk of foot-and-mouth disease infection being conveyed by material such as food, litter, &c., accompanying the animals. A shipping permit issued by the High Commissioner in London will be necessary before any shipments are made.

It is intended to deal with the matter legislatively during the present session of Parliament in connection with a measure consolidating and superseding the existing Rabbit Nuisance Act. Under this measure the Minister of Agriculture becomes the permit authority.

SEASONAL NOTES.

THE FARM.

LUCERNE-MANAGEMENT.

MANY promising stands of lucerne are injured by grazing the crop hard in the winter. Rye-grass, Poa annua, white clover, catsear, and rib-grass—all common weeds in lucerne—establish best on ground where there is a short turf and plenty of light. Cutting in late autumn and grazing during winter, when the lucerne is practically dormant, thus expose the stand to weed invasion. Lucerne-fields are best left over the winter with a fair growth on them to check weed-growth and keep the lucerne vigorous. Young stands especially are benefited by the late autumn growth being allowed to stand over the winter.

Lucerne will benefit in the early spring from a good cultivation with a tine cultivator, just before the crop starts vigorous growth. Cultivation at this stage checks the weed-growth, and stirs and aerates the soil, and then the vigorous growth of lucerne smothers out most of the weeds that are left. The cultivator should have tines with sharp points and stir the soil between the lucerne-plants, but the tines should not be fitted with wings which may injure the crowns of the plants. Disks are often used on lucerne-fields, but they are inclined to injure the crowns and thus allow the plants to be invaded by the spores of root-fungus.

Lucerne responds well to top-dressing with phosphatic fertilizers, and practically all stands will benefit from a spring application of 3 cwt. to 4 cwt. per acre of superphosphate or basic super.

Land intended for sowing lucerne should be ploughed during August, and the crop should preferably follow grass, when the soil will be at the highest state of fertility. Early ploughing is essential if the grass turf is to be properly decayed by the time the crop is sown. Lucerne does best on deep, friable, well-drained soils; land where the watertable is near the surface in the winter is quite unsuitable.

TILLAGE OPERATIONS.

August is a busy month on the arable farm. The sowing of spring cereals and the ploughing of land for spring and summer-sown root and forage crops will keep the teams or tractor busy on all days the land is fit to work. Normally the spring work can be lightened by making every endeavour to get the stubbles intended for root and forage crops turned over in the early winter, and grassland intended for turnips and rape should be ploughed if possible before the sowing of spring cereals. Early ploughing, besides increasing the amount of moisture held in the land for the use of crops, exposes the soil to the weathering agencies of the atmosphere, and the breaking-down of the soil under the influence of the weather will lessen the amount of cultivation work necessary in the spring to obtain a fine seed-bed.

In dairying districts of the North Island there is normally no imperative need for the early winter ploughing of grassland for root and forage crops, owing to the high rainfall experienced. The land should be broken up by the middle of August, so as to allow sufficient time for the grass-sod to rot before the crop is sown. On many of the lighter soils of Auckland Province the winter fallowing of grassland is often disastrous. In many places the pastures contain a good deal of brown-top, red-top, and Poa pratensis, and although these grasses may not be very noticeable in an old pasture before it is broken up, they are rejuvenated by ploughing and grow vigorously during the winter, when the land cannot be touched owing to the wet weather. Land on which these grasses are likely to be troublesome should never be winter-fallowed by skim-ploughing the lea in autumn or early winter, but should be ploughed in August with a skimmer attachment on the plough, and be kept worked up during the spring until the crop is sown.

INTENSIVE PASTURE-MANAGEMENT.

It is probable that much more intensive methods of farming grassland will be undertaken on dairy farms in the near future. Intensive grass-farming consists in close subdivision, regulated stocking, and heavy manuring. Grass is treated as a crop—the pasture being allowed to reach a height of 4 in. to 5 in., quickly grazed down, and then spelled until the next crop of young grass is ready. The seasonal growth of grass and the seasonal requirements of the dairy cow render the planning of a system of intensive grass-farming somewhat complicated. In adopting more intensive methods it would be desirable for a start to closely subdivide one half of the farm, and treat the grass on this area as a crop to be grazed always at the right stage; the remaining half could be used for grazing when the grass on the intensively farmed half was not ready, for the saving of hay and ensilage, and the growing of supplementary crops for periods of grass shortage. The grass of the whole farm would require top-dressing with phosphatic fertilizers as at the present time, but the grass-growth on the intensively farmed half would be stimulated by nitrogenous dressings in the late winter, the late spring, and autumn.

A question of particular interest at this period of the year is the efficacy of sulphate of ammonia for increasing the early spring growth of grass, and experiments to test the value of 1 cwt. per acre of this fertilizer applied in July are now under way. Most farmers now save some of the winter growth of grass for early spring, but this growth is usually finished by the middle of August, and there is a period of grass shortage from the middle of August to the middle of September that is difficult to fill. The efficacy of sulphate of ammonia in increasing the early spring growth will depend a good deal on the type of pasture top-dressed. The growth will be most vigorous on pastures that have been brought to the rye-grass standard by regular top-dressing with phosphates over a period of years.

—*P. W. Smallfield, B.Ag., Instructor in Agriculture, Auckland.*

THE ORCHARD.

LATE PRUNING OPERATIONS.

A REMINDER is given to orchardists who have not yet been able to complete their pruning to proceed with the work as quickly as possible, so as to get it finished before the trees start into growth for the new season. It is also advisable, if time permits, to examine the trees after pruning, especially with regard to the number of fruit-buds and spurs left on the trees. A superabundance of fruit-spurs usually means heavy blossoming, but not necessarily a heavy setting of fruit. In fact, the opposite is often the case; consequently a little extra time spent on the thinning of fruit-spurs is well worth while. Cox's Orange Pippin, Sturmer, and Delicious are varieties that are apt to stop in growth as the tree reaches maturity and heavy fruit-production commences It is often found necessary to cut back two or three years' growth, eliminating all spurs and fruit-buds for a further 4 in. to 6 in. for the purpose of promoting growth and restoring vigour.

The destruction of all prunings as soon as pruning is finished will help considerably against the spread of disease in the orchard.

SPRAYING.

From now on till picking-time the spraying equipment will be in more or less constant use. To save time and inconvenience later in the season a thorough overhaul of the pump and engine should be given, examining all parts to see that everything is in good order. Hose should be tested and replaced where necessary, and a sufficient supply of spraying materials should be obtained. Where home-made lime-sulphur is used extensively a good supply should be made and barrelled for use throughout the season. Very few growers spray their trees during the dormant period, preferring to wait until the buds begin to swell in early spring, but it has to be admitted that a good spraying with red oil occasionally is very beneficial, especially where lime-sulphur sprayings have been given repeatedly over a number of years.

A knowledge of the pests and diseases affecting fruit-trees leads to more intelligent spraying, and thus helps considerably in control. A grower should be able to identify the different pests and diseases, to enable him to apply the proper solutions, whether for sucking-insects requiring a contact spray, chewing-insects requiring a poison spray, or fungoid diseases requiring a fungicide. The principal contact sprays for use against sucking-insects are lime-sulphur, red oil, and Black Leaf 40; poison sprays against chewers, arsenate of lead; and lime-sulphur, bordeaux and precipitated sulphurs for the control of fungus diseases.

Stone-fruits will in all probability be the first requiring spray, in order to cope with leaf-curl, shot-hole, and brown-rot, and to keep in check any San Jose scale or red mite that may be present. Bordeaux at strength 8–6–40, just before the buds begin to swell, will be found very effective against the spores of leaf-curl and shot-hole fungus. Another application in the early pink stage of blossom development at strength 3–4–40, should be given where necessary. For the control

of red mite and San Jose scale either red oil or lime-sulphur can be used at the semi-dormant period, driving the spray with sufficient force to penetrate every crevice where these pests usually congregate. Red oil, at strength 1–15 to 1–25 according to advance, will do good work. If lime-sulphur is used, a strength of 1–15 should be effective; this spray will also assist in the control of fungus diseases.

CULTIVATION AND MANURING.

The ploughing of the orchard should be taken in hand as soon as possible, burying all leaves and rubbish, &c., to avoid any chance of disease infection from this source. If the trees are hoed or dug round at this time of the year, much extra work will be saved later on, when the ground gets harder as the warm weather approaches. Soon after ploughing is finished, and before spraying starts, the orchard should be harrowed down, making it easier for the spray-machine to travel over the ground, and in some cases avoiding breakages. Where stationary spraying plants are used, the breaking down of the ploughed ground might be left till later, although it is much easier to drag a lengthy hose over an even surface than over furrows.

The good results obtained from the use of manure in the orchard will no doubt influence many growers in this respect. Liming may be done before the ploughing, other manures, such as superphosphate, basic slag, and bonedust, following slightly later and being harrowed in. Applied at this time of the year, better results will be obtained than later when warm weather sets in.

GENERAL.

Many of the older varieties of fruit-trees, proving unprofitable, are worked over every season, and the question naturally arises as to the best variety to substitute. Greater consideration is being given to the later varieties. Of these both Statesman and Granny Smith can be relied upon to give good results in the majority of districts, although the advice of the district Orchard Instructor as to suitability is recommended before any extensive reworking is done. Scions may be collected during the pruning season and stored in a cool damp place, preparatory to grafting during spring when the sap begins to move.

Wiring of the trees in the orchard should be given attention at this time of the year, when they are in a more or less upright position, making the operation much easier. Although the initial cost of wiring may be heavy, the advantages gained more than compensate for the outlay.

An examination of fruit in cool store should now be made, marketing any variety that is showing signs of wilting or rotting. In repacking from the store care should be taken to see that only good sound fruit is sent forward to market.

Planting of new areas can be proceeded with, providing the land is in suitable condition. If the land is inclined to be wet, the young trees should be heeled in until such time as the ground is fit for working. A small quantity of blood-and-bone manure applied when planting will assist the young trees very materially.

—*G. Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

Routine work among citrus-trees in the coming month will consist of harvesting fruits as ready, attention to surface drains to take away surplus water, and the provision of light protection of scrim or brushwood to young trees against frost. Shelter-belts may be trimmed, and new shelter planted as required.

Land should now be prepared for any new plantations. Good drainage is essential; unless this is natural—which is much to be desired—artificial underdrainage must be provided, or the trees may be expected to languish rather than thrive. A thorough working of the surface soil and first subsoil is also advisable, but this should be done uniformly over the whole area and to the same depth. One often finds that immediately under where the tree is to be planted the subsoil is dug to an extra depth when opening the hole for planting. This is bad practice, as it only encourages water to stagnate in the basin to the detriment of the tree. General surface levelling should also be done, filling in depressions which would be likely to hold surface water.

Special work of the month will be a general pruning of the trees to prepare them for the spring growth. At this season surplus branches on lemon-trees should be cut out, to allow light and air to penetrate generally throughout the tree. Lemons are carried on fruiting-wood right throughout the tree, and only when fruit laterals have space to develop can these be matured to advantage. Oranges are only found on annual fringe wood extensions; more of a globular bush habit is therefore desirable with them.

Towards the centre of lemon-trees can generally be found soft growths of a very woody nature; these are best suppressed, as they are rarely fruitful. Branches or laterals which cross should also be cut back, as bark chafe is decidedly injurious. In pruning the larger wood the work should be done in a way which will maintain and encourage the more horizontal wood—"pruning down," as it is termed by some growers. In a general way, the more upright the wood the less likelihood of good fruit-bearing laterals being formed. All cuts should be made clean by smoothing off the ragged edges with a knife after sawing, and the cut surface coated with coal-tar. Throughout the trees are to be found laterals which have carried fruit and become worn out; if really old and non-vegetative these should be cut away, but if young and in good vigour they may be cut back to a good bud, which may be expected to make a further lateral.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

HATCHING REMINDERS.

POULTRY-KEEPERS who have not commenced hatching-operations are reminded that August and September are the best months to have the chicks coming out; chicks brought out later seldom prove satisfactory. No time, therefore, should be lost in securing the required number of young birds for the season. In many cases, of course, hatching-operations will be delayed till October or even later,

owing to the inability to secure broody hens. But the poultry-keeper who is really anxious to secure highly profitable stock will not delay his hatching-operations by waiting for broody hens. He will adopt artificial methods, and thereby be able to have all his stock hatched out at the right time.

It is now recognized that the maximum returns cannot be secured from poultry unless late autumn and winter eggs are produced in good numbers. It is also recognized that the pullets must be chiefly depended upon to produce these, and to do so the chicks must be hatched by the end of September at latest. In a general way, this involves the adoption of artificial methods, as on most plants it is almost impossible to secure the desired number of broodies when they are required. Even on the general farm artificial means must be resorted to, either by using an incubator or by purchasing day-old chicks from a reliable breeder, and rearing these by means of an up-to-date brooder.

OVERDUE HATCHES.

The invariable cause of chicks not hatching on time is that the incubator has been maintained at too low a temperature. The thermometer may have been placed too high above the eggs, or it may not be accurate. If eggs do not pip up to time (say, at the twentieth day for hen-eggs and the twenty-sixth for duck-eggs) the only safe course to take, before the machine is again set, is to have the thermometer tested, and to see that it is hung in the correct position, the bulb being allowed to rest against the top surface of a fertile egg. Naturally an incorrect temperature may be secured from the reverse position through the thermometer being too far below the level of the tops of the eggs.

For hen or duck eggs the temperature at the level of the tops of the eggs on the tray should be about 102° F. the first week, 103° the second and third weeks, and 104° when hatching. There need be no alarm should the temperature vary slightly for an hour or two, but if longer than this, particularly during the early stages of the incubation process, the germ is apt to become impaired and the success of the hatch affected. When the correct degree of heat is spoken of this means the temperature required by the germ of the egg, which is always floating uppermost quite irrespective of the position of the egg. Of course, eggs that are stale always take longer to hatch than those which are fresh.

It will generally be found that really good hatches are obtained only when the hatchable eggs pip and hatch about the due time, and in the case of hen-eggs when all the available chicks are out of the shell on the twenty-first day. Thus, if the breeding-stock are in proper condition, the eggs fairly fresh, the thermometer kept on a level with the germs, and even then the hatch is delayed, it is, as before indicated, as well to have the thermometer tested or a new one obtained.

One little point may be mentioned in regard to duck-eggs. While these usually commence to pip on the twenty-sixth day, they do not hatch out until the twenty-eighth day. Therefore, do not open the machine or attempt to assist the young birds out of the shell until they have at least had their full time to hatch.

How to Test a Thermometer.—Place a clinical thermometer and the one to be tested in water at 100° F; stir gently, adding slowly at the same time hot water; and observe the different readings. If the incubator instrument reads, say, a degree lower or higher than the clinical, it must be worked a degree higher or lower accordingly.

DETERMINATION OF AGE OF DUCKS.

A correspondent wants to know how to definitely tell the age of a duck. So far as the present writer is aware, there is no means by which this can be ascertained. The condition of the windpipe, however, is a good guide as to whether or not a bird is an old or a young one. If the windpipe is hard to the touch, it is safe to say the bird has passed the duckling stage. On the other hand, if the windpipe is soft and yielding to the touch it indicates that the bird is comparatively young. In applying this test with a live bird care must be taken that the windpipe is not squeezed to the extent of injuring the bird. With a dead duck the condition of the upper part of the bill gives a good indication as to its age. In a young bird the bill can be pressed back and easily broken, while with an old one this will be found a difficult matter unless great pressure is used. Another way of deciding between an old and a young bird is the manner in which the breast-bone can be pierced with, say, a sharp hat-pin. With a young bird the bone can be pierced with but little pressure, but in the case of an old one the reverse is the case.

THE SITTING HEN.

A matter for first consideration when setting a hen is whether she is free from insect pests. The hen should be well dusted with an insect-powder before being entrusted with the eggs, and again prior to hatching. On no account should she be dusted when the chicks are very young, as the powder is apt to get into their eyes and cause blindness. Not only should the hen be free from vermin, but care must also be taken that the coop is free from red mite. The hen should be isolated from the poultry-house, as few houses are as free from vermin as they might be. Another advantage of keeping the sitting hen away from the poultry-house is that she will not be disturbed by other members of the flock. The presence of vermin and continued disturbance by other fowls are the most common causes of hens leaving their nests before hatching takes place. The hen will usually sit better if the nest is made in a rather dark place. A common practice is to set a hen in a confined box where she must be necessarily let off once a day to feed and drink, as well as for the purpose of keeping the nest clean. It is, however, a much better plan to set the hen in a coop with a roomy run attached. She can then have before her at all times all she requires in the way of food and water, and can leave and return to the nest as she pleases.

When setting a hen the great aim should be to follow nature as closely as possible, and yet have the hen under control. To achieve this end, and to guard against the chicks being carried away by cats, stoats, or weasels, the best and cheapest course in the long run, as already indicated, is to provide a proper coop and run for the mother hen and her brood. It is always advisable to make the coop in such

a way that it can be easily moved to fresh ground. It should be rat-proof, while the run should also protect the little birds from their natural enemies.

The run should not be made too small. If the chicks are to develop into robust stock they should have ample room to scratch and exercise. It is always a wise plan to have a floor to the coop, unless, of course, it is under cover, so that the birds may not be swamped out during wet weather. When making the nest place 3 in. or 4 in. of moist earth in one corner of the coop. The earth may be kept in place by means of four bricks. Shape the nest so that the eggs will have a slight tendency to roll to the centre, care being taken to see that it is roomy and flat in the centre. This will allow the hen the necessary room to turn the eggs, which she does several times a day. The nesting-material may consist of dry grass, hay, or fine straw. A good plan is to first put the hen on a few china eggs until satisfied that she can be entrusted with the eggs intended for hatching.

When the hatch is completed the hen may be given a feed of grain, preferably out of a tin or something similar, but there is no hurry to feed the chicks for at least twenty-four hours. The egg-shells should be removed and the nest made comfortable, one of the bricks being also taken away, so that if a chick jumps out of the nest it may easily return to it. Many chicks are drowned by jumping into deep water-vessels, and this risk should be minimized by using a shallow water-tray.

The food for sitting-hens should consist of whole grains, maize being included when available. This, with grit and clean water, is all that is required. Mashes, meat, and green food are apt to slacken the bowels and cause the eggs to be soiled, to the detriment of the hatch.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

WINTER CONDITIONS.

As indicated last month, there is little a beekeeper can do for the welfare of his bees at this period beyond examining the hives for leaky covers and damp mats. If any are found in this condition they should be replaced. All manipulations of the bees should cease, and the bees, having been made as snug as possible, left until the arrival of the warm spring days.

LOCATING AN APIARY.

As the supply of grass and clover regulates the amount of stock carried on a given area, so does the same condition apply to what might be termed the grazing of bees. Unrestrained and at liberty, the bees fly where their desire prompts them, even to a distance of three or four miles from their home ; but this is not necessary if a suitable site has been chosen. Rich land where clover grows abundantly and little cultivation is done is more suitable for bee-keeping than any other kind ; and land of this description may be found in any dairying or bullock-fattening district. Sheep-grazing land is usually eaten

too bare, yet occasionally I have heard of good flows of nectar from valleys in such areas. Plenty of willows scattered over good country add materially to the value of a district in supplying early spring bee-feed; while a patch of native bush close by would also be advantageous in this respect. Catsear is also valuable as a nectar-producing plant, the honey being of an amber colour, smooth-grained, and of good flavour. After clover has finished blooming, thistles, if in any quantity, may be expected to furnish an excellent honey of a white colour, and this, blended with clover and catsear, forms a very fine product, and always commands the highest price.

SHELTER.

Next to selecting a good locality, arranging for good shelter is the most important matter. The formation of the neighbouring ground would perhaps assist in this respect. If there is any choice, select a low, well-drained spot, which will enable the bees to fly down when loaded for home. Such a position will also lend itself more readily to being sheltered. It is preferable to make use of natural shelter, if handy, providing the trees are not too large to cause a draught; where there is open country I would advise putting up a temporary fence of boards or brushwood on the sides of the prevailing winds until a substantial green fence has grown. Tagasaste (*Cytisus proliferus*), sometimes called "tree-lucerne," grows very rapidly, and makes a good shelter in two seasons. It should be planted about 2 ft. 6 in. apart, and the ground round the roots kept free from weeds. It stands a great amount of cutting, and flowers along the branches very early in spring, thus forming a very welcome addition to other early honey-producing plants.

Bees should not be placed too close under big trees or immediately under hedges, or in any damp place, for under these conditions they become irritable and the combs are liable to get mouldy. Bees require shelter, but at the same time plenty of sunlight.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

TOBACCO-CULTURE.

THOSE who are making experimental plantings of tobacco have now to consider the details of sowing and raising the seedlings. This may be done in shallow trays 2½ in. to 3 in. deep. If trays made from petrol-tins are used, holes should be made in the bottom to allow for drainage. The soil should be a mixture of three parts good fresh loam and one part well-rotted manure. A little bonedust, and sufficient sharp sand to keep the soil from setting hard or forming a crust, should be added. Place the more fibrous portions of the compost in the bottom of the tray, then fill it up, and press the soil down firm with a small piece of board, so that the surface is level and half an inch or so below the edge of the tray.

Sow the seed thinly and press it into the soil. If any covering is given it should be of the lightest description, and is best applied

by shaking the soil or sand through a fine sieve. If the soil is on the dry side, water it before sowing and allow all stickiness to dry off before that is done. A sheet of glass placed over the trays will prevent excessive evaporation, which is an advantage, as it is important that the soil should not be allowed to become dry at this stage, and because of the difficulty of watering without disturbing the seed. Shading is also beneficial at this stage, and it may be done by covering the glass with a sheet of paper.

The most suitable place for such trays of tobacco and other half-hardy seedlings at this season is in a cold frame on a hotbed. A hot-bed may be made of fallen leaves from deciduous trees or strawy stable manure, or both together. The material is brought into condition by setting up a steady fermentation throughout the whole mass, thus causing it to heat. The temperature is increased and the period extended according to the size of the bed. For this purpose comparatively fresh material is required, and it should be placed in a compact heap. In four to five days it will be very hot, and should be shaken out and restacked, meanwhile watering with a sprinkler any portions that are dry. This has the effect of steadying the heat, making it more general and lasting. After a similar interval this operation may have to be repeated. When it has heated up after the last turning the bed should be carefully stacked, meanwhile treading it firm. A height of 2 ft. to 3 ft. makes a good hotbed, and if the frame is to be placed on top the bed should be 1 ft. wider and longer than the frame. In warmer districts it is found sufficient if the fermenting material is placed in the frame to a depth of 1 ft. to 2 ft. After stacking, leave the bed for three to four days, then water it well, and place the glass sashes on and it is ready for use. As this preparation will take about a fortnight, it should be commenced in ample time before the period of sowing the seed.

A careful watch must be kept to see that the temperature in the frame after the seeds are sown is not allowed to become excessively high, or on frosty nights to fall too low. From 55° to 60° F. is a very good mean, and steps should be taken to cover or ventilate the frame if there is a tendency for either to be exceeded. Such a bed should, of course, be made in a well-drained location that is warm and well sheltered.

TOMATOES, CHILIS, EGG-PLANTS, ETC.

Tomatoes, capsicums (chilis), egg-plants (aubergines), Cape gooseberry, and other half-hardy plants may be raised from seed on a hotbed similar to that described above. In the northern and warmer districts it will be generally suitable to start them towards the end of August. Chili and egg plants are rather more tender than others of the class, and should be started and planted out two to three weeks later. These should be ready for planting out from the end of October to the middle of November. The plants should be raised clean and sturdy, but not before they may be planted outside. If raised too soon, and they have to remain in the boxes till the weather is suitable for planting them out, they receive a check that is injurious, especially to the early and more valuable portion of the crop.

Under glass it is now time to apply such fertilizers as may be necessary, and to complete the preparation of the soil for setting out the tomato-plants towards the end of the month. Houses that have been neglected sometimes have the soil in an overdry condition, and it requires a good soaking some time before planting. This should be carefully considered, as such a saturation is apt to check the plants if applied soon after planting. If the land is in a suitable moist condition before planting comparatively small quantities of water will be required during the cooler weather, and there is less risk of chilling the plants. The method of planting in shallow furrows has much to recommend it; it facilitates watering at this period, and as the furrows gradually fill in it increases the rooting system. After planting, the ventilation of the houses needs very careful attention; it is easy and very usual to give too much at this season. Avoid draughts and extremes of temperature; 55° to 65° F. is best. Close the houses in the middle of the afternoon while they are on the warm side.

BUSH FRUITS.

Where plantings of bush fruits are to be made it should be done on the first occasion the land is in condition. Gooseberries and red currants, requiring plenty of sun and air, should be planted 5 ft. to 6 ft. apart both ways. Black currants have a very different character, and are best planted closer in the rows; 3 ft. is not too close for most varieties. Raspberries are no doubt best planted singly 1 ft. apart and 5 ft. to 6 ft. between the rows. Plant firmly and prune the plants well back to induce vigorous growth and quick establishment.

VEGETABLES FOR MARKET.

Correspondence received shows that greater interest is being taken in the celery and asparagus crops. They require a good deep friable soil that is moist but well drained. Other soils can be made more or less suitable, but for commercial purposes a naturally suitable soil is necessary if costs are to be kept down and best results obtained. Celery is in greatest demand during the winter months, and for that market it should be planted out in the month of January, necessitating the sowing down of seed-beds about the month of October. For commercial production there appears no reason why the American method should not be successful here—that is, to plant 8 in. to 9 in. apart in shallow furrows, 3½ ft. to 4 ft. apart, and earthed up for purposes of blanching. The seeds are sown in beds outside and grown under shade, while eight to ten days before the plants are lifted for planting out they are wrenched—that is, the tap roots are cut to facilitate removal. The plants in the beds must be kept moist and clean. The latter point is very essential, and at least two applications of bordeaux, 4-4-40, should be given before the plants are lifted.

Asparagus is a permanent crop which requires a well-sheltered situation. Seeds sown now will produce roots for planting out twelve months hence. Sow the seeds 1 in. deep in rows 15 in. apart, and when 3 in. high thin them to 4 in. to 5 in. apart. A sowing of 5 lb. of seed should produce sufficient plants for an acre of land. If the sowing is delayed the growing season is shortened, and the plants will be

comparatively small. Germination of the seed, which is naturally rather slow, may be hastened by soaking it in warm water for twenty-four hours. This treatment will facilitate weeding.

In addition to the seeds mentioned in last month's notes (which may still be sown) sow main crop onions, turnip-rooted beet, early carrots, parsnips, parsley, radish, and early turnips. Sow thinly, and so reduce the labour of thinning the plants and wasting the seed.

PLANTING OF TREES AND SHRUBS.

Where it is intended to plant hedges, and shelter, shade, ornamental, or fruit-trees, or nuts, the work should now be done at the very first opportunity, as if deferred there will be a risk of a higher proportion of losses. However, the trees should not be planted if the ground is not prepared nor the planting well planned; it is far better to defer planting till another season than do such permanent work hastily. Take the usual precautions and plant very firmly. Most plants of any size will require to be cut back rather severely to compensate for the loss of roots. The exception is chiefly in the case of conifers, but even with them a little judicious pruning is advisable if the plants are of any size.

LAWNS AND GREENS.

New lawns or alterations to old ones should be sown down or turfed without further delay. If bare patches in playing-greens are turfed now with grasses of the right kind a good even sward will be very quickly established. Old lawns will derive great benefit from a dressing now of sulphate of ammonia, at the rate of 1 oz. to 2 oz. to the square yard. With careful cutting and treatment with a light roller a good surface should be obtained.

—*W. C. Hyde, Horticulturist, Wellington.*

INTERIM RETURN OF SHEEP AT 30th APRIL, 1928.

Sheep District.	Number of Sheep. Final Return, 1927.	Number of Sheep. Interim Return, 1928.	Difference.
Auckland	2,289,488	2,374,512	+ 85,024
Gisborne - Hawke's Bay ..	6,317,884	6,508,028	+190,144
Wellington - West Coast ..	5,350,448	5,546,421	+195,973
North Island totals ..	13,957,820	14,428,961	+471,141
Marlborough-Nelson-Westland ..	1,369,648	1,351,185	− 18,463
Canterbury-Kaikoura	5,102,411	5,505,442	+403,031
Otago (including Southland) ..	5,219,137	5,715,648	+496,511
South Island totals ..	11,691,196	12,572,275	+881,079
Dominion totals ..	25,649,016	**27,001,236**	**+1,352,220**

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JANUARY TO JUNE, 1928.

Dairy Division.

THE half-year covered by the appended list is the quieter period of the C.O.R. system, owing to the comparatively small number of dairy cows in this country which are timed to calve between New Year and June. It will be noted that a number of meritorious performances are included in the forty-five records comprising the list.

LIST OF RECORDS.

*Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.		Fat req'd for Cert.	Yield for Season.		
					Days.	Milk.	Fat.
	JERSEYS.	Yrs.	dys.	lb.		lb.	lb.
Junior Two-year-old.							
Te Aute Clementine ..	W. T. Williams, Pukehou ..	2	22	242·7	363	8,073·7	484·57
Conandale Royal Flush	S. Dale, Fairlie	1	288	240·5	365	6,551·8	412·13
Brookley Fairy ..	E. W. Jacobs, Horotiu ..	1	210	240·5	365	6,755·0	392·10
Jersey Nook Tui ..	R. C. Leach, Woodville ..	2	18	242·3	305	6,237·1	378·11
Okauia Leaflet ..	R. K. Garland, Okauia ..	1	290	240·5	311	7,157·3	370·19
Balla Mona Tiki ..	J. Hunt, Richmond ..	1	306	240·5	365	8,405·9	368·94
Kia Ora Lodestar ..	R. E. Clements, Dargaville..	1	359	240·5	257	5,458·0	303·36
Senior Two-year-old.							
Riverside Royal Gem	J. T. Belcher, Cardiff ..	2	124	252·9	365	8,655·6	490·02
Corra Lynn Miss Swan	A. Best, Bombay ..	2	359	276·4	365	8,417·0	440·40
Lisbury Lalabelle ..	F. Jennings, Mauriceville ..	2	165	257·0	365	7,772·1	422·27
Holly Oak Comedy Queen	L. A. McDonald, Levin ..	2	253	265·8	273	7,333·9	417·84
Majesty's Brilliant ..	G. Hodgson, Whakapara ..	2	272	267·7	314	6,940·4	414·67
Three-year-old.							
War Bride of Puketapu	T. H. Western, Bell Block..	3	135	290·5	365	10,961·7	679·61
Riverside Bangle ..	J. T. Belcher, Cardiff ..	3	35	280·5	365	8,636·3	487·18
Analysis	Mrs. I. W. Speirs, Levin ..	3	179	294·9	325	6,940·0	399·94
Okauia Lucille ..	R. K. Garland, Okauia ..	3	245	301·5	364	5,861·3	338·45
Four-year-old.							
Willow Bank Rose ..	J. T. Belcher, Cardiff ..	4	26	316·1	365	10,008·0	517·29
Momona Mahuika ..	Mrs. I. W. Speirs, Levin ..	4	235	337·0	365	9,699·9	465·13
Hui Mai Vanity ..	Mrs. I. W. Speirs, Levin ..	4	230	338·5	362	8,833·6	445·49
Mature.							
Holly Oak Merry Moments	John Hale, New Plymouth..	6	14	350·0	365	11,538·9	665·24
Marchioness Patricia	J. C. Hodgson, Whakapara..	5	91	350·0	365	13,739·5	656·13
Elf's La Primevere ..	John Robb, Westmere ..	5	118	350·0	365	10,324·7	626·28
Housemaid.. ..	H. J. Lancaster, Glen Oroua	9	125	350·0	354	10,162·4	553·60
Tikihuna	F. S. McRae, Palmerston N.	7	237	350·0	365	9,034·4	524·27
Mauriaena Fairy ..	C. G. Aickin, Auckland ..	6	11	350·0	365	9,405·1	517·97
Richwood Rose ..	C. G. Aickin, Auckland ..	8	264	350·0	363	8,630·3	426·12

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS.				
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Hobson Alcartra Pontiac†	Hobson Farm, Ltd., Wharepapa	2 116	252·1	364	10,971·1	370·12
Totara Pontiac Maud*	Piri Land Co., Auckland ..	2 150	255·5	210	9,550·4	328·18
Junior Three-year-old.						
Ohio Sensation* ..	C. H. Potter, Pukerau ..	3 8	277·8	365	16,427·8	590·21
Totara K. P. Winnie Winthorp*	Piri Land Co., Auckland ..	3 101	287·1	365	15,936·0	561·05
Senior Three-year-old.						
Rosevale Sylvia Burkeyje*	North and Sons, Omimi ..	3 263	303·3	365	15,355·8	619·39
Pareora Butter Girl Cadillac*	A. S. Elworthy, Timaru ..	3 194	296·4	365	15,538·0	597·63
Junior Four-year-old.						
Rosevale Gipsy Abbekerk Posch*	North and Sons, Omimi ..	4 155	329·0	365	22,086·6	703·41
Mature.						
Rosevale Gladys Posch*	North and Sons, Omimi ..	8 24	350·0	365	28,555·2	940·43
Pareora Queen Ailsa*	A. S. Elworthy, Timaru ..	5 64	350·0	365	16,413·5	678·49
Muriel Mercena of Edingwood†	Piri Land Co., Auckland ..	5 151	350·0	365	16,886·5	607·08
Ryvington Pontaic Stately†	T. O. Hodgson, Tamahere ..	5 27	350·0	365	15,497·5	582·58
Rosevale Helena Keyes*	McDonald and Co., Waitati	6 42	350·0	365	14,944·0	469·62

Second-class Certificates.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Days.	Milk.	Fat.
		Jerseys.				
Senior Two-year-old.						
Kelvin Bright Eyes ..	G. Buchanan, Paeroa ..	2 290	269·5	333	5,976·9	299·78
Four-year-old.						
Over Proof ..	W. A. Burgess, Ruawai ..	4 20	315·5	363	6,541·9	367·64
Mature.						
Holly Oak's Princess*	Late W. T. Williams, Pukehou	7 12	350·0	365	14,430·9	681·30
Rewarder's Bella ..	G. Taylor, Ngarua ..	8 24	350·0	365	6,928·5	409·17
		Friesians.				
Senior Two-year-old.						
Rosevale Korndyke Queen	North and Sons, Omimi ..	2 289	269·4	365	19,502·0	669·66
Mature.						
Wyuna Rose† ..	A. G. Wood, Tikorangi ..	8 8	350·0	364	22,439·3	769·65
		Ayrshires.				
Mature.						
Maesgwyn Maire ..	C. M. Williams, Kaiapoi ..	6 57	350·0	365	16,419·9	638·80

REVIEW.

Plant Hunting. By ERNEST H. WILSON, M.A., V.M.H., Keeper of the Arnold Arboretum of Harvard University. Two volumes; xxix plus 275 pages, with 128 illustrations. The Stratford Company, Boston, Mass., 1927.

To that large majority who love gardens this delightful book will be brimful of interest, nor will it, when once begun, be readily laid aside until read from cover to cover. But the circle of its readers will be wider still, since it appeals to all who care for descriptive geography, for the characteristic plants of different lands are a distinguishing mark equally with their inhabitants and their languages.

Assuredly the flower-garden is one of the greatest amenities of civilized life, but we are generally content to leave it at that, and to give no thought as to the origin of its brilliant or fragrant tenants. Yet usually few of these are native to the soil, but have been brought from many lands, the world at large from seashore to alpine heights having been ransacked. Indeed, they represent the untiring and self-sacrificing labours of that intrepid band of pioneers—the "plant-hunters," the names of many of whom (mostly forgotten) and their worthy deeds are set forth in this book by the author—himself one of the foremost of them, and probably the very foremost. Who now, for instance, when preparing his chrysanthemums for the local show or admiring his bushes of azaleas with their glistening blossoms gives a thought to Robert Fortune, who first brought them and many other famous Chinese plants to Britain, and with his introduction of the tea-plant to India laid the foundation of a great industry? Or how many among us have ever heard of Francis Masson—"pioneer and forerunner of the many plant-collectors sent out from the famous Kew Gardens"—who reached South Africa in 1772? Yet to him we owe the beautiful and quaint green ixia and many other bulbs with brilliant flowers.

These labours of the plant-hunters are arduous enough, and frequently have more than a suspicion of danger. Thus the author, speaking of his experiences in Formosa—"Pearl of the Orient," he styles it—soliloquizes, "Well, if they take a fancy for my head during the night I do not see what is to prevent them from taking it." And he proceeds, "Gathered around several fires were two score half-naked ex-head-hunters armed with bows and arrows, long knives and guns." But consider the reward to the lover of nature when he gazes on natural gardens never seen before by civilized man. Writing of his experiences in "that remote hinterland which separates western China and the Thibetan Plateau" the author says, "To picture these alpine regions during the short summer that is theirs, one must visualize mile upon mile of colour spuming like foam about a storm-tossed shore—seas of yellow, red, orange, blue, violet, and purple. From sun-kissed snows of dazzling whiteness, treacherous glaciers, and hummocked moraines, downward stretch green grassy areas decked with a million flowers of every hue." Then of the Sikkim cowslip—a plant readily cultivated in New Zealand wherever our true alpine plants can be grown—he tells us that "In moist meadows, and by the sides of streams and ponds, it occurs in thousands and hundreds of thousands, like cowslips in an English meadow. On many a plant may be counted twenty scapes, each with large umbels of flowers filling the air around with soft delicious odour."

The floral gems of many countries are described: for instance, those of the tropics, where one revels in "Natures luxurious extravagance"; the Orient—"Mother of gardens whose bounteous crops enrich the world"; Korea—"Land of the morning calm"; Japan—"Land of the Rising Sun"; and South and Central Africa—"Sunlit lands whence came Gladiolus and a thousand other familiar plants that gladden lives with their beauty."

To us here the 150 pages devoted to Australia and our own country must be of special interest. Though these regions are so close, their vegetation and plants bear hardly any resemblance, and our flora of some 1,800 species looks rather small as compared with the 10,700 species of Australia. Also, as the author explains, New Zealand possesses no species of the

dominant types of Australia—*e.g.*, "Eucalyptus, Acacia, Grass-tree, Banksia, Melaleuca, Casuarina, Callitris, nor Cycad." All the same, the author has a very warm place in his heart for New Zealand—"Queen of the Southern Seas," as he calls her—and he devotes no less than three chapters to the flora and the vegetation. "Green, intense green," he declares, "is the keynote of New Zealand." And, of course, he pays a tribute to our ferns, of which he truly says, "Forty genera in 140 species grow there, but these figures give no adequate idea of the real richness of New Zealand's fern-flora." At the head of all our trees and shrubs for garden purposes he places the mountain-ribbonwood, *Gaya Lyallii* (its present name is *Hoheria glabrata*, the third time the name has been altered), but he explains it is too tender for the great garden over which he rules, as are, in fact, all New Zealand trees and shrubs. Many of the genera come under review, and the importance of their species for gardens is emphasized; in short, a necessarily brief but trustworthy account is given of New Zealand plant-life, and its salient features are stressed.

In addition to the author's botanical treatment of the Dominion, he deals with other matters, giving, for instance, much praise to its scenery—and he is surely a qualified judge. And, to turn to a quite different subject, the following statement must find a place here. "Of the fragrant recollections I retain of New Zealand none is pleasanter than that of the mutual respect I found among whites and Maoris one for the other. There, at least, alien races live together in amity and good fellowship, equal in political status, tolerant and neighbourly toward each other."

A book so informative and dealing with matters of interest and importance to the whole community should be in all our reference libraries and in the circulating libraries of the large towns. It also contains exactly that measure of plant geography suitable for these seeking to obtain the Diploma of the New Zealand Institute of Horticulture.

L. COCKAYNE.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 17th May to 12th July, 1928, include the following of agricultural interest:—

No. 57652: Cheese-disk follower; W. A. McDonald, Wyndham. No. 57838: Hay-sweep; J. I. Carter, Waipawa and J. Hyslop, Hawera. No. 58607: Fertilizer; Imperial Chemical Industries, Ltd., London. No. 60282: Farm tractor; C. Murnane, Melbourne, Vic. No. 60283: Machine for gathering subterranean clover; F. S. Hill, Cobden, Vic. No. 60379: Cleaning cereals; Henry Simon (Aust.), Ltd., Sydney, N.S.W. No. 58488: Wire-strainer; A. A. Baker, Ngaruawahia. No. 58510: Milking-machine installation; D. M. Wallace, Te Aroha. No. 58547: Milking-machine installation; B. Waterson, Apiti. No. 58897: Manure-sower; A. J. Redding, Midhirst. No. 59800: Milking-machine claw; T. P. Hackett, Momoma. No. 60261: Separating seed; J. N. Mitchell, Sydney, N.S.W. No. 60270: Sheep-dip race; J. T. Coddington, Cunningbar, N.S.W. No. 60340: Cream-separator; D. M. Wallace, Ltd., Te Aroha. No. 60341: Milk-strainer; D. M. Wallace, Ltd., Te Aroha. No. 60444: Sheep-shearing machine comb-plate; R. A. Lister and Co., Ltd., Dursley, Eng. No. 58633: Bag-lifter; T. McFadden, New Brighton. No 59051: milk-pasteurization; A. H. Templeton, Dunedin. No. 60402: Animal drinking-fountain; G. Allman and S. B. Hemming, Parkerville, W. Aust. No. 57688: Scarifier; E. W. Poole, Dannevirke. No. 58835: Hedge-cutting machine; C. Collett, Invercargill. No. 59868: Weed-destroyer; H. W. de Castro, Wellllington. No. 60180: Manure-sower; H. T. Lowry, Patumahoe. No. 60327: Pig-snout-cartilage cutting; A. P. Horne, Buckland. No. 60565: Potato-picker; P. Dahlman, Grandy, Minnesota, U.S.A.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

WEATHER RECORDS: JUNE, 1928.

Dominion Meteorological Office.

GENERAL NOTES.

JUNE was a wintry month, with a marked predominance of cold south-west or southerly winds. Temperatures were below normal in many parts, but, except in the southern portions of the South Island, frosts were not particularly numerous or severe. The majority of the strong winds blew along the length of the Islands, with intermittent shiftings to a more southerly or south-easterly direction. Their force was therefore felt mainly in the northern and southern extremities of the country and in the surrounding ocean waters, with occasional visitations on parts of the east coast. The parts exposed to the winds received more than their usual quota of rainfall for the month. The Bay of Plenty, Waikato, Taranaki, Wanganui, Marlborough, Nelson, and Westland districts, and the interior of the South Island, however, had less than the average, the deficiency amounting to as much as 70 per cent. in some cases. Nelson and Taranaki experienced particularly fine weather.

The storms which occurred during the month were mainly of the cyclonic variety, four principal ones being recorded. Westerly winds were again conspicuous by their absence. The cyclone centres all passed north of Cook Strait Three of them were responsible for stormy conditions over the whole of the Dominion. Of these the first passed Cape Maria Van Diemen on the 10th, and subsequently moved in a south-south-east direction past the Chatham Islands. Southerly gales and general rains were experienced on the 11th and 12th. During the approach of the storm between the 7th and 9th pressure was high to the east of New Zealand.

On the 14th and 15th, while a moderate anticyclone was covering New Zealand, an intense cyclone developed off the coast of New South Wales. Moving slowly eastward, the centre passed through Cook Strait on the 18th. From the 15th to the 21st the weather was almost continuously dull and unsettled, with more or less rain. On the 18th the rain was general, and there were fairly widespread falls of snow in the South Island and the central parts of the North Island. North-easterly gales blew in the North on the 15th and 16th, and fairly general southerly gales from the 18th to the 21st. On the 21st there were again extensive falls of snow, while hail was reported in many places.

The last cyclone appeared between Cape Maria Van Diemen and Norfolk Island on the 26th, causing northerly gales in North Auckland. Moving south-eastwards and intensifying, this disturbance caused strong south-westerly winds to gales and much rain in the last three days of the month. There was a lull, however, on the night of the 28th during the development of a secondary depression. This was followed on the 29th by the third fall of snow for the month in parts of Canterbury and Otago, some of it even reaching the Plains country. Hail, also, was experienced at some stations. Auckland Province suffered worst from this storm, the northern portion experiencing north-easterly gales during its approach, while westerly and southerly gales were more general in its rear. Considerable damage was done to telegraph-wires, trees, and even buildings. Some damage was done, also, by the southerlies in the South Island, especially Southland.

—*Edward Kidson, Director of Meteorological Services.*

RAINFALL FOR JUNE, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average June Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	10·25	18	2·14	3·53
2	Russell	8·70	12	2·28	7·15
3	Whangarei	12·67	19	2·72	6·22
4	Auckland	5·84	22	1·40	4·91
5	Hamilton..	3·22	16	0·47	5·19

RAINFALL FOR JUNE, 1928—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
	North Island - continued.				
		Inches.		Inches.	Inches.
6	Kawhia	3·10	16	0·38	5·72
7	New Plymouth	3·71	17	0·89	6·14
8	Riversdale, Inglewood ..	5·42	17	0·97	10·31
9	Whangamomona	3·70	10	0·57	7·62
10	Eltham	4·87	16	0·85	5·46
11	Tairua	6·30	13	1·58	7·38
12	Tauranga	4·73	12	2·18	5·42
13	Maraehako Station, Opotiki	1·86	8	0·72	5·99
14	Gisborne	6·15	17	1·52	5·28
15	Taupo	1·27	5	0·60	4·48
16	Napier	2·05	17	0·49	3·59
17	Maraekakaho Stn., Hastings	3·51	21	1·26	3·35
18	Taihape	3·02	18	0·64	3·85
19	Masterton	4·48	19	1·14	3·48
20	Patea	3·40	13	0·80	4·15
21	Wanganui	3·02	10	0·60	3·19
22	Foxton	2·22	10	0·68	2·96
23	Wellington (Karori Reservoir)	5·66	18	1·31	4·63
	South Island.				
24	Westport	4·78	18	0·92	7·53
25	Greymouth	4·99	14	1·24	8·27
26	Hokitika	4·43	14	0·92	9·60
27	Ross	5·51	11	1·68	9·20
28	Arthur's Pass	3·45	13	1·00	10·12
29	Okuru, Westland ..	4·89	5	2·00	10·76
30	Collingwood	3·76	15	0·91	11·33
31	Nelson	1·58	6	0·97	3·69
32	Spring Creek, Blenheim ..	2·22	4	1·40	3·01
33	Tophouse	2·66	11	0·80	4·75
34	Hanmer Springs	4·22	17	0·83	3·11
35	Highfield, Waiau	2·40	9	0·70	2·49
36	Gore Bay	6·24	15	1·98	2·34
37	Christchurch	4·83	20	1·78	2·66
38	Timaru	2·01	11	1·10	1·70
39	Lambrook Station, Fairlie	1·50	7	0·64	1·91
40	Benmore Station, Clearburn	0·54	15	0·16	1·90
41	Oamaru	1·14	9	0·48	2·01
42	Queenstown	0·57	4	0·29	2·46
43	Clyde	0·28	5	0·08	0·98
44	Dunedin..	1·65	12	0·59	3·15
45	Wendon	2·50	12	0·47	2·42
46	Gore	2·94	19	0·48	2·82
47	Invercargill	5·03	20	1·08	3·60
48	Puysegur Point	7·22	21	0·89	6·58
49	Half-moon Bay, Stewart Is.	3·89	20	0·49	4·51

Corrections in Interim Returns of Live-stock.—The Census and Statistics Office advises the occurrence of certain errors in these returns as published in the *Monthly Abstract of Statistics* for June. Extracts printed on page 37 of this issue of the *Journal* must consequently be corrected as follows: Horses, 294,255 (not 299,112); sheep shorn, 23,797,130 (not 24,500,731); lambs tailed, 13,068,738 (not 13,484,243). The errors in the *Abstract* all occurred in connection with the Wellington Land District figures, these affecting the Dominion totals equally.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SHEEP MAGGOT-FLIES AND THEIR CONTROL.

J. A. PYLE, Kenepuru Head :—

I require a little information in regard to the blow-fly: (1) What breed of sheep is most subject to fly-attack? (2) Why is it that the fly will attack sheep that are perfectly clean and not those that are dirty? (3) What is the best preventive?

The Live-stock Division :—

(1) Given suitable conditions, any breed of sheep is equally liable to blow-fly attack, and no particular breed is more subject than another. (2) While it is undeniable that a considerable amount of clean wool is blown, yet practical experience shows that the dirty sheep is usually the first to be attacked, the blow-fly laying its eggs on the soiled wool around the crutch. However, this can occur on any part of the sheep, and along the back is common. When apparently clean sheep are struck, a probable explanation is the presence of moisture in wool, such as might happen after rain. Climatic conditions giving rise to even slight irritation of the skin on the back will attract the fly. It is also known that sheep in sheltered valleys are more liable to attack than those in high, exposed country. (3) Prevention begins in removal of breeding-places of the blow-fly; dead carcasses must be destroyed by burning or burial, and offal, &c., must not be left lying about. Sheep must be kept clean and well dagged. Dressing of cuts at shearing time is necessary. Dipping, of course, is the best method of prevention, although this cannot be said to act as a complete preventive. The powder arsenical dip gives the best results, as the ingredients are held longer in the fleece. The dip should be absolutely clean. Dipping sheep in a dirty dip predisposes to the trouble. A good deal of work has been done by the Department of Agriculture towards establishing an effective insect parasite of sheep maggot-flies in New Zealand, and, while it may be too much to hope for complete protection from this source, such may in time considerably lessen the pest and the damage it causes.

ALMOND VARIETIES FOR CROSS-POLLINIZATION.

"AMATEUR," Tolaga Bay :—

Please advise me as to the best variety of almond tree to plant, and also give me the name of a pink-flowering kind. I have a large Lewelling almond, and am told it will not bear unless a pink-flowering variety is planted near. It is covered in white blossoms every season, but the fruit just drops off, only a few maturing. I have two small Jordans in the same orchard not yet bearing.

The Horticulture Division :—

Experience with almond-trees in this country is somewhat limited, but the most promising varieties are Nonpareil, I X.L., and Ne Plus Ultra. The pink-flowered kind you refer to is probably *Amygdalus communis*, a very popular species, but I.X.L. and Ne Plus Ultra flower at the same period as Lewelling, and it is most probable that one at least would be effective as a cross-pollinizer.

RIDDING TURKEYS OF WORMS.

"PUZZLED," Pihama :—

I should be grateful if you would inform me of the right remedy to use to get rid of worms in turkeys.

The Live-stock Division :—

We would advise you to try the following treatment: Starve the birds for a day, and then give them a dose of Epsom salts (about one 1 oz. packet for every ten birds) dissolved in the water with which the mash is mixed, adding also to the mash some sulphur (about the same amount as the salts) and a teaspoonful of pure spirit of turpentine for every four birds, the whole to be mixed with the ingredients before they are moistened. Repeat, if necessary, in a week's time.

TOP-DRESSING OF DAIRY PASTURE.

"SUBSCRIBER," Woodville :—

I am dairying on 36 acres of land. This past season I carried seventeen cows, and they will return approximately 5,500 lb. butterfat. The same farm would only carry eight cows five years ago before liming and top-dressing with super. I have followed the Department's advice of liming in the autumn and top-dressing in the spring with super. What I want to know is this: (1) Will the lime and super burn up or exhaust the nitrogen and other plant-foods in the soil after a few years of boosted production? (2) Will the luxuriant growth of clovers and the double carrying-capacity of the land replace the nitrogen, &c., by way of nitrogen from the air and the droppings from the cows? (3) If super is applied to land after liming, does the land become sour after a number of years continuous treatment? (4) Would it be better to apply a basic super to the soil instead of liming with carbonate of lime and top-dressing with super later? (5) Should the action of lime be upon the soil or upon the super first, as in the case of manufacturing basic super? I ask these questions because I am being repeatedly told that in a few years my farm will go back to a sour exhausted condition.

The Fields Division :—

(1) and (2) Continuation of your practice, as described, instead of depleting the soil will lead to an increase of available supplies of those plant-food substances. The supply of total potash will be reduced, but this will be to such a slight extent as to be not worth consideration unless your soil is very abnormal in potash content. (3) The answer is in the negative. (4) and (5) As a general rule, the application to the land separately of lime and superphosphate may be taken to be the better practice. An outstanding virtue of super lies in the fact that its supply of phosphate is in a water-soluble form. This means not only that super is relatively very ready in its action, but also that valuable phosphate is distributed throughout the soil in a much more thorough manner than could be achieved by any other means. In basic super the phosphate is not water-soluble. To sum up, continuation of the practices you describe will lead to increased rather than to decreased productiveness of your farm. Regular and systematic use of the combined chain and tripod harrows on the pastures will materially assist in this process of improvement.

REMOVING WOOL FROM SHEEP-SKINS.

C. WAITES, Queenstown :—

I should like to know the best way to take wool off old dried sheep-skins.

The Live-stock Division :—

Considerable work is entailed in removing wool from skins, especially under your circumstances, and it would seem advisable to sell the skins with the wool on them. The following recipe, however, is sometimes used for removal: Dissolve 1 lb. caustic soda in 2 gallons water; add sufficient slaked lime to make a good thick paste; apply this with a brush to the flesh side of the skin; fold skin over lengthwise, wool side out; leave until next day; then pull wool off the skin. One must wear leather gloves when painting on the paste, also when pulling the wool off the skin, so as to avoid burning the hands. The skin must be thoroughly soaked in water a little while before the paste is applied, the degree of soaking depending on its dryness.

PROTECTION OF VEGETABLES FROM SMALL BIRDS.

"RUBUS," Hakaru :—

Could you give me a recipe for birdlime? If any actual lime is used, please state what kind. I want to try the birdlime for skylarks; they ruin all our early vegetables; it is impossible to keep everything covered.

The Horticulture Division :—

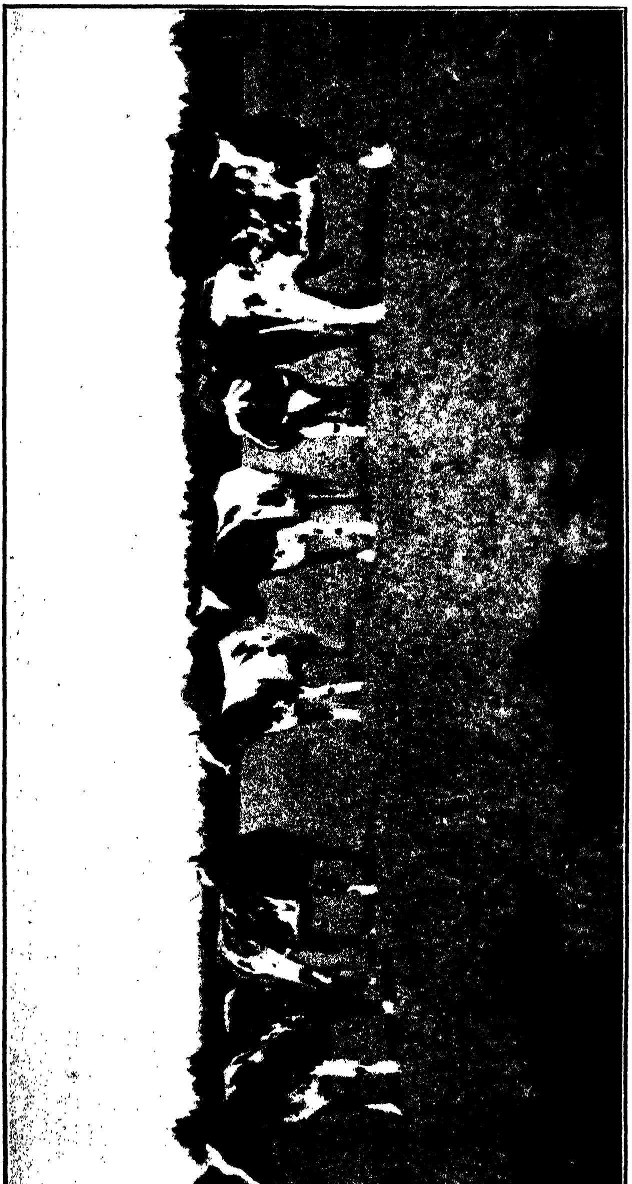
We regret not having a reliable recipe for birdlime. The Syrian birdlime is excellent, and used to be imported and sold by Mr. A. A. Corban, of Mount Lebanon Vineyards, Henderson. You might try an adhesive that is used for bandaging fruit-trees in some countries. It is composed of eight parts resin and four parts rape-seed oil melted together, or 12 oz. castor-oil and 27 oz. resin. To protect seeds from birds, many kinds may be soaked in kerosene for a few minutes before sowing, or they may be moistened only with kerosene and sprinkled with powdered red-lead, shaken up together to distribute the substance, and spread to dry before sowing. These methods are very effective. Young plants will be protected to a great extent if they are sprayed or dusted with almost any of the remedies used in fungus or insect control.

VARIETIES OF APPLES AND PEARS EXPORTED, SEASON 1928.

THE following particulars of the varieties of apples and pears exported from New Zealand in the past season have been compiled by the Horticulture Division from export certificates. The figures for apples represent 1-bushel cases, and those for pears crates consisting of three trays, each tray containing from 10 lb. to 12 lb. of fruit.

Apples.—Sturmer, 272,892; Jonathan, 218,322; Delicious, 171,018; Dunn's, 69,424; Cox's Orange, 56,551; Dougherty, 41,452; Statesman, 25,683; Cleopatra, 15,000; London Pippin, 10,561; Rome Beauty, 8,982; Ballarat, 8,048; Worcester Pearmain, 6,961; Rokewood, 6,026; Lord Wolseley, 5,943; Newtown Pippin, 5,087; Tasma, 4,866; Stayman's Winesap, 4,103; Premier, 3,584; Spitzenberg, 3,034; Pioneer, 2,446; King David, 2,350; Grannie Smith, 2,009; Salome, 1,944; Scarlet Nonpareil, 1,889; Adams Pearmain, 1,594; Alfriston, 1,549; Stark, 1,426; Gravenstein, 1,421; Willie Sharp, 1,194; Yates, 1,148; Ribston Pippin, 1,062; Shorland Queen, 816; Hoover, 783; Brownlee's Russet, 668; Edward Lippiatt, 662; Brighton, 576; Golden Pippin, 539; Parlin's Beauty, 442; McLiver's Winesap, 423; Blenheim Orange, 409; Stone Pippin, 367; Simmonds Winter, 366; Celo, 314; Frimley Beauty, 256; Tasma Pride, 241; McMahon's White, 235; Boston Russet, 219; Democrat, 132; Scarlet Pearmain, 126; McIntosh Red, 125; Commerce, 106; Baumann's Reinette, 89; Black Ben Davis, 82; Glengyle Red, 51; Grooby's Seedling, 47; Shepherd's Perfection, 33; Senator, 24; Grime's Golden, 23; Golden Delicious, 21; Rona, 20; Crofton, 20; Sharp's Late Red, 4. Total number of cases, 965,788.

Pears.—Winter Nelis, 18,808; P. Barry, 13,382; Winter Cole, 10,201; Josephine de Malines, 3,147; Beurre Bosc, 2,012; Packham's Triumph, 1,863; Doyenne du Comice, 1,133; Vicar of Winkfield, 644; Beurre Clairgeau, 468; L'Inconnue, 358; Beurre Diel, 271; Glou Morceau, 237; Conference, 130; Marie Louise, 125; Keiffer, 111; Giblin's Nelis, 99; Harrington's Victoria, 86; Elizabeth Cole, 71; Beurre d'Amanli, 70; Louise Bonne de Jersey, 50; Beurre Capiaumont, 50; Williams Bon Chretien, 49; Beurre d'Anjou, 25. Total number of crates, 53,390.



AYRSHIRE HEIFERS AT RUAKURA FARM OF INSTRUCTION.

DAIRY FACTORIES IN NEW ZEALAND, 1928.

THE following table presents the registrations of factories under the Dairy Industry Act as at 30th April last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1928, and the numbers of milk or cream suppliers to the factories :—

District.	Number of Factories.				Forwarded for Export, 1927-28.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
					Tons.	Tons.		
Auckland ..	59	31	8	98	47,155	11,206	17,456	1,304
Taranaki ..	18	66	38	122	8,518	32,635	3,042	3,239
Wellington ..	19	48	8	75	8,489	11,431	4,973	1,544
Hawke's Bay ..	12	15	2	29	3,329	3,387	3,906	548
Nelson	7	3	1	11	1,082	459	1,152	425
Marlborough ..	3	1	4	8	642	718	695	197
Westland ..	8	2	1	11	487	38	619	42
Canterbury ..	9	14	3	26	1,738	1,901	4,756	1,884
Otago and Southland	9	77	1	87	2,037	12,427	6,981	2,896
Totals ..	144	257	66	467	73,477	74,202	43,580	12,079

Whey butter was manufactured as a side-line at eighty-one of the above cheese-factories in 1927-8, the total quantity forwarded for export being 1,117 tons. This is not included in the total amount of 73,477 tons of butter given in the table, which refers to creamery butter only.

In the 1927-8 period there were also operating in the Dominion six milk-powder factories (three whole-milk and three skim-milk plants), four casein-factories, two condensed-milk factories, and one sugar-of-milk factory.

WOOL-RABBIT FARMING.

A USEFUL little book entitled "Angora Wool Rabbits for Profit," by Arthur Sainsbury, editor of the *New Zealand Smallholder*, has recently been issued by the Brett Printing and Publishing Co., Ltd., Auckland. The book deals with the industrial aspect of the subject, and comprises sections on the breeding, farming, feeding, and housing of Angora rabbits, rabbit ailments, &c. Now that the importation and keeping of these animals has been conditionally authorized, as referred to elsewhere in this issue, the book (which is priced at 4s. 3d. posted) will doubtless find many readers.

Checking of Milk and Cream Tests at Factories.—Referring, at the National Dairy Association Conference last month, to the initiation of this work by a special officer during the past season, Mr. W. M. Singleton, Director of the Dairy Division remarked : "The work is deemed so important that we are expecting to have an additional officer appointed for this work next season. Special attention has been given to those dairy companies which had highest yields during the preceding season. It is intended to follow the work up even more assiduously. These officers will work under direct instructions from Wellington so far as the check testing is concerned. This arrangement is to safeguard the good feeling existing between factory-managers and our dairy instructors. We do not want factory-managers to get the impression that butter and cheese instructors are inspectors. Up to the present we can scarcely get the managers to realize that the check-testing officer is an inspector. One factory-manager actually requested a visit of the check tester. It appeared to be evident that the inspector would find little if anything wrong at that factory."

The New Zealand

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POTATO-CULTURE.

THE MAINTENANCE OF PURE AND VIGOROUS CROPS.

J. W. HADFIELD, H.D.A., Agronomist, Department of Agriculture.

THE inspection of potato crops in connection with certification has afforded excellent opportunities for instructional work. A grower who may be mildly interested in potato-growing in general finds his interest greatly stimulated when his attention is drawn to the shortcomings of his own particular crop, and has brought home to him the importance of adopting improved methods and the effect these might have upon the returns from his personal efforts.

Certain points are continually raised. Most of them are not new, and have been so repeatedly discussed in this and other journals and between growers that there would be no justification for further discussion were it not that recent research has thrown considerable light upon these several points. In the present article the writer will attempt to reply to some of these questions from his own experience, and in the light of recent investigation undertaken by such workers as Dr. R. N. Salaman in England, Dr. P. Murphy in Ireland, and Mr. T. P. McIntosh of the Board of Agriculture, Scotland.

"Seed" Considerations.

CUT VERSUS WHOLE SEED.

The practice of cutting table tubers for seed purposes is adopted periodically by the more progressive growers, who find in this a means of maintaining the purity and cropping-power of their varieties. It is not suggested that this method should be adopted in the planting of a main crop, for unquestionably the use of whole seed from 1½ oz. to 2 oz. in weight is the most economical for this purpose. The difficulty is that the continual planting of small seed brings in its train two important defects: Firstly, the line may become impure; and, secondly, it is almost certain to degenerate or run out.

Our main red potato, the Dakota, is an extremely important variety, but, as all growers and consumers know, it has become mixed with other reds of an inferior quality. These rogues produce a larger proportion of seed potatoes than does the Dakota, and they multiply more rapidly when seed-size sets are used. Rogueing in the field is not

reliable, as even the most experienced and expert grower cannot pick some of the rogues with any degree of certainty. Since most of them can be detected by their yellow flesh when the table tubers are cut, this practice helps a great deal towards keeping the variety pure.

Arran Chief is perhaps the most important commercial white potato, and in this variety Northern Star (Gamekeeper) is the main rogue (Fig. 1). On light land the Northern Star produces a remarkable number of seed-size tubers, and 1 or 2 per cent. in a variety such as Aucklander will multiply at an incredible rate. A rogue that may pass undetected in a line of seed will be more apparent when table potatoes are handled.

These advantages are generally recognized by growers, but it is perhaps not so commonly recognized that the practice plays a very important part in avoiding one of the most serious conditions which affect commercial potato-growing. This condition, generally referred to as running out, is directly due to the group of diseases known collectively as virus disease. Many a grower whose crop is badly run out will acknowledge that he has harvested a very poor crop of table potatoes but "a very nice line of seed." Such seed will, of course, carry the trouble, and once diseased the stock is apparently permanently and incurably infected. A plant infected with virus disease will produce few, if any, tubers of table size, depending upon the degree of infection; consequently the use of table tubers will avoid in some measure this and other diseases.

The writer recently inspected the crop owned by a grower who is recognized as having a very pure line of a certain variety. The grower was much perturbed by the fact that for some years he had been obtaining successively poorer yields. The reason was very obvious, for the ground after digging was littered with the old unrotted tubers, which is one symptom of virus disease. The previous season he had selected some of his best table tubers and planted these down one row in his main crop. The difference between this row and the rest of his crop was so striking as to afford him most convincing proof of the value of selection. It might be mentioned that the value of the produce from this row for seed purposes would be minimized by the fact that the plants were exposed to infection from the surrounding crop. He was advised to dispose of his entire stock and purchase certified seed, but growers evince a remarkable affection for lines that have been in their hands for a number of years. The writer also inspected two widely separated crops grown from seed originating from this particular line. They were both incapable of producing much more than a crop of seed-size tubers, and were therefore a loss to the grower and a menace to the next grower who, in turn, might purchase this seed. It is obvious that the distribution of such lines should be checked, and the introduction of certification is designed to cope with such cases.

Cutting of table tubers for seed has also another benefit, in that it enables the detection of those diseases of which one symptom is the discoloration of the vascular tissue. This tissue lies about ¼ in. below the skin, and wilt disease (Fig. 2) and mattery eye may be detected by cutting a slice off the heel end of a tuber. Indications are that it would pay to deal in this way with every tuber and discard those which show vascular discoloration. Unfortunately, in many cases

FIG. 1. NORTHERN STAR ROGUE (FOREGROUND) GROWING IN A CROP OF ARRAN CHIEF.

This rogue is the most common impurity in Arran Chief crops, and can be detected by its dark smooth leaf, dense foliage, and almost total absence of colouring in the stems, which are also not so angular as those of Arran Chief.

[*Photo by H. Drake.*

FIG. 2. DEMONSTRATING EFFECT OF WILT-DISEASE ON TWO PLANTS OF SAME VARIETY.

The plants were marked during the growing season—one as healthy and the other as being infected with early wilt. The effect upon yield and size of tubers is quite typical, and a strong argument in favour of selection or of using cut table potatoes for the planting of a seed-production plot.

[*Photo by J. H. Claridge.*

the average man would give up the plan as impracticable, for not infrequently 20 per cent. to 30 per cent. would have to be discarded. Moreover, it is necessary to take the precaution of using two knives and a dish containing a strong solution of formalin. As soon as a knife has been used on a diseased tuber it should be dropped into the dish, and the disinfected knife taken out and used for the next cutting.

This leads one to the conclusion that the cutting of table tubers for seed purposes is a very desirable practice, but owing to the loss from misses it is not one that can be recommended for the main crop. One would, however, unhesitatingly recommend growers to plant each year with cut table tubers a seed-production plot of sufficient size to supply their seed requirements for the main crop. The seed-plot should be isolated as far as possible; the worst place for it to occupy would be a number of rows running down the centre of the main crop, where it would be liable to infection from both sides.

PREVENTION OF LOSS IN CUTTING.

It is well known that some varieties will not stand cutting. The Aucklander (N.Z. Sutton's Supreme) is a notable example of this. A simple and very effective means of preventing misses is to plant and cover immediately after cutting—that is, before the cut surfaces become dry. The writer had adopted this simple precaution with the Aucklander variety and experienced no loss from misses.

When planting on a large scale this precaution is hardly practicable, and the "wet bag" system adopted in certain parts of Australia might well be tried with advantage in the hot, dry climate of Canterbury. This consists of dropping the cut sets into wet sacks and thus keeping the tubers damp from the time they are cut till the time they are planted and covered.

Drying agents, such as carbonate of lime, gypsum, and superphosphate, may be of some benefit if the sets have to be kept for any length of time, and may assist in the formation of a protective coat over the cut surface. When cut sets have to be kept they should not be bagged up immediately. A sack of freshly cut sets is liable to sweat and heat to an extent sufficient to damage the sprouts. They should not be allowed to dry rapidly, otherwise the protective suberin layer is not properly developed on the cut surface. The ideal is a cool moist atmosphere, and this may be produced by spreading the sets on a floor and covering with damp sacks for a few days.

SIZE OF SEED.

The average size seed used by growers in the South Island is about 1¾ oz.; in the North Island trade a larger size is demanded. From 1½ oz. to 2 oz. is perhaps the most economical for the planting of a commercial crop, although one must bear in mind what has already been mentioned in connection with the continuous use of such seed. Large seed may, in comparison with very small seed, produce a slightly heavier total crop, but this difference is not so marked as is the nature of the resultant crop. The use of large seed will tend to the production of a crop containing a large proportion of seed-size tubers, and, conversely, the use of small seed produces a crop containing proportionately a greater number of table-size tubers.

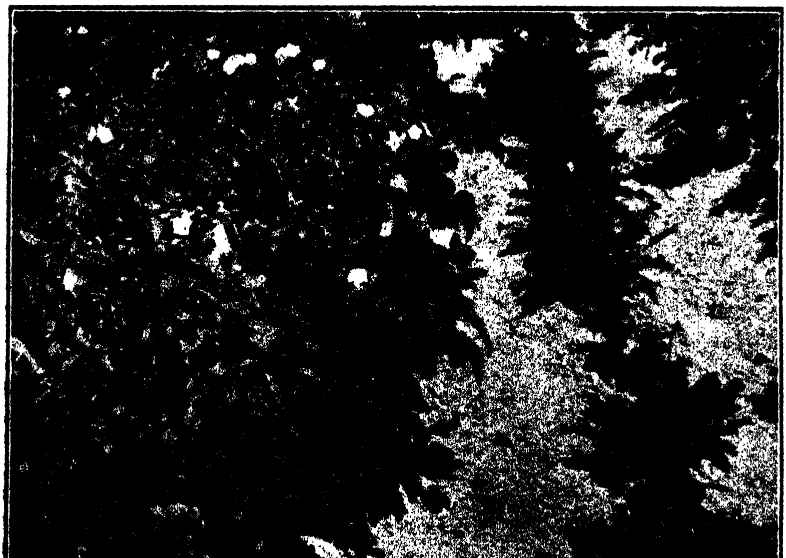


FIG. 4.

SINGLE-PLANT SELECTIONS OF AUCKLANDER TALL-TOP (N.Z. SUTTON'S SUPREME) AT EARLY AND LATER STAGES OF GROWTH.

These selections were made from the 1926–27 crop, when the shaws were dead and the tubers ready for digging. At this stage it is impossible to detect virus disease, as is evident from the fact that when these selections were grown in the 1927–28 season one was found to be badly infected. The photos show (above) the early and (below) the late growth of this degenerate selection in comparison with that of the more healthy ones, and demonstrate the advantages of making selections while the crop is still growing.

It is probable that the use of seed of about 1½ oz. to 2 oz. for the planting of a commercial crop will result in the maximum proportion of table size, with the minimum reduction in total yield. Those who are growing entirely for the seed trade might well consider the advisability of planting their uncut table potatoes, which in the ordinary course they could not market as seed. Small sets and large sets, irrespective of the size of the tuber from which they were cut, produce the same result as from large and small seed.

It seems obvious that once a reasonably high standard of health is attained the present practice in connection with seed size is the most economical one to follow.

MATURE VERSUS IMMATURE SEED.

As far back as the year 1880 writers have advocated the use of immature seed, and there are few growers in this country who do not know that this practice is beneficial, however few there may be who practise it. Immature seed is best harvested after flowering and before the shaws are commencing to show signs of ripening. The tubers are still too thin in the skin for marketing in the ordinary way, but if greened the skin becomes tough and the tubers can be handled in sacks without any danger.

The benefit to be derived from the use of immature seed is generally attributed to having by this means avoided infection from virus disease. That is to say, there has not elapsed a sufficient time for the immature tubers to become infected with those diseases carried by the parent plant, although, unfortunately, this does not appear to be the whole explanation of the case. In parts of Scotland and elsewhere virus disease is not much in evidence, and it is reported that in such localities no beneficial results follow the use of immature seed. Dr. Murphy has demonstrated that when virus disease is absent the use of fully mature seed is of distinct advantage.

At present it is not known whether there are any parts of New Zealand comparable to those parts of Scotland and Ireland that to-day produce the bulk of the high-quality seed used for planting the less-fortunate potato-growing areas. The popularity of Southland seed may be explained along these lines, so also may be the practice of sending seed from the South to the North Island. These are matters of very great importance which have not yet been investigated in this country. From the evidence available we can only conclude that the use of immature seed, as adopted by the North Auckland and Pukekohe growers, would be a desirable feature of potato-growing in many parts of New Zealand. If not practicable for the main crop it should be so in connection with the selected tubers used for planting the seed-plots referred to earlier.

GREENING AND SPROUTING.

The value of sprouting seed tubers is generally recognized, but it seems futile to advocate a measure which is, or is said to be, not practicable. On those farms in Canterbury growing potatoes the average area is estimated at about 12 acres*, and it would be difficult

* E. J. Fawcett, this *Journal*, Vol. 33, p. 305.

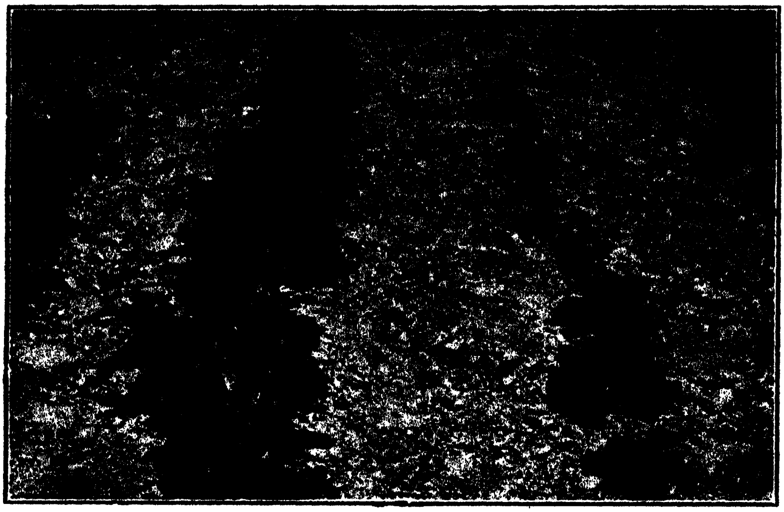


FIG. 6.

SINGLE-PLANT SELECTIONS OF HEALTHY AND VIRUS-INFECTED ARRAN CHIEF AT EARLY AND LATER STAGES OF GROWTH.

During the growing season of 1926–27 some healthy and virus-infected plants were marked. The produce of each plant was kept separate and planted during the 1927–28 season. The photos show the early and later growth during the past season of this one healthy and one virus-infected selection. This demonstrates very clearly the transmission of virus disease from one season to another by means of the seed tubers.

for a grower to find satisfactory accommodation for such a large quantity of seed. It would, however, be practicable to sprout the greened seed to be used in the seed-plot. The use of sprouted seed hastens maturity, and this results in an increased yield in those crops harvested before they are mature. At maturity there may or may not be any increase, hence from the point of view of yield, the practice is of most value in crops grown for the early market.

The sprouting of seed affords an excellent opportunity for culling defective sets. A large proportion of rogues may be identified through variation in the sprouts. Tubers having long weak sprouts should be discarded, as they may be suspected of carrying virus disease, while the condition termed " spindle-sprout " is known to every grower. Tubers with relatively shorter and thicker sprouts produce the strongest plants, and sprouting should be carried out in a cool moist atmosphere where moderate light will induce greening and prevent undue elongation and consequent weakening of the sprouts.

Greening makes the skin tough, and is of particular importance when handling immature seed. If the potato-moth is not active and there is no danger of frost the tubers may be left on the ground for a week or two before being picked up, or they may be spread out in the corner of a grass-paddock. In either case the moisture from the soil prevents undue shrivelling, and the result of this practice is the production of remarkably good seed.

CHANGE OF SEED.

The evidence brought forward by the writer and another in last month's *Journal* clearly proves that a number of growers are in urgent need of a change, and certification affords such growers a guide as to where satisfactory seed may be obtained. This, however, is not quite the point of view to be discussed here.

Growers frequently say that it is time they had a change of seed ; but the result of a change is often disappointing, and one would like to know whether there are any localities in New Zealand particularly suited for seed-production From evidence in other countries one would recommend the introduction of seed from a higher altitude or a colder climate to a lower altitude or warmer climate ; it might be equally accurate to say from a district with a short growing-season to one with a long growing-season. An experiment designed to determine whether there is any advantage in sending seed from Canterbury to be grown in Southland for one or more years has been carried out for one season with negative results. In this case a line of Arran Chief grown continuously at Ashburton for several years, sent down to be grown at West Plains, near Invercargill, for one season and returned to Ashburton, has not benefited by the change. This is contrary to expectations, but it will take several seasons to prove the point.

There is no evidence to support the statement that a change from one soil-type to another is beneficial. All the evidence points to the fact that the benefit to be derived from a change is a measure of the relative freedom from virus disease in the introduced line. The point is very important, and growers should realize that the indiscriminate exchange of seed is likely to result in no benefit, and should be carried out with a definite objective. Since avoidance of virus disease is the

sum total of the proved benefits from a change of seed, it is obviously very important that a survey should be undertaken to determine the distribution of virus disease in New Zealand.

Variation in the Potato.

The nature of variation in the potato has been the subject of much investigation in recent years. It is not intended to discuss this here, and it is sufficient to say that these variations may be termed somatic or germinal according to whether they are heritable or not.

Somatic variations do not arise from or cause any change in the germ plasm; they are non-heritable variations due to environment. Such characteristics as cooking-quality, shape, and roughness of skin in any particular variety are modified by soil and climatic conditions, and, while such modification may cause confusion in the identification of varieties, they are transient, and play no part in the production of new types. Germinal variations differ from somatic in that they are heritable, and under that heading are classed mutations. A mutation is a plant which shows some sudden variation not attributable to cross-fertilization. Mutations in the potato are most commonly observed as changes in the texture and colour of the skin, although there is some doubt whether all or only some of these variations are true mutations. They may be due to the addition of a character not previously observed, as in the coloration of Maori Chief, said to be a mutant from Gamekeeper, itself a selection from Northern Star. More often they represent the loss of a character, as when white tubers arise in a coloured variety. Except for the russet skin, Field Marshall is identical with Up-to-Date, in which it may have arisen as a mutant. Golden Wonder is a russet-skinned replica of Langworthy. There are instances in which the flower has changed colour, and the variety General is a white-flowered President (Iron Duke).

The discovery of these variations is almost always a source of temptation. The grower has at hand, ready-made, an old variety under a new guise, and he is tempted to add it to the all too long list of varieties now being grown. It may therefore be wise to quote the following from Dr. Salaman's book, "Potato Varieties": "It may be concluded that a mutant form which differs from the normal type by the loss of colour in the flower or the skin of the tuber, and to a still greater degree if in both, is extremely unlikely to exhibit any character which would render it superior. Indeed, such mutants are, in general, inferior in both yield and vigour to the normal type. . . . Enough has been said to show that it is not by way of bud-mutations that we must look for new varieties, for such undoubted ones as have occurred amongst our domestic strains have failed to produce any form superior to their immediate parent."

Two other types of variations, known as "bolters" and "wildings," are to be found in many varieties. Nothing definite is known as to their origin, although some authorities regard them as mutations.

Bolters: These may be most commonly observed in Up-to-Date and Epicure, and are most easily recognized in the latter. The plants are tall and late-maturing, and produce a relatively large number of flowers. They are more resistant to such diseases as early and late

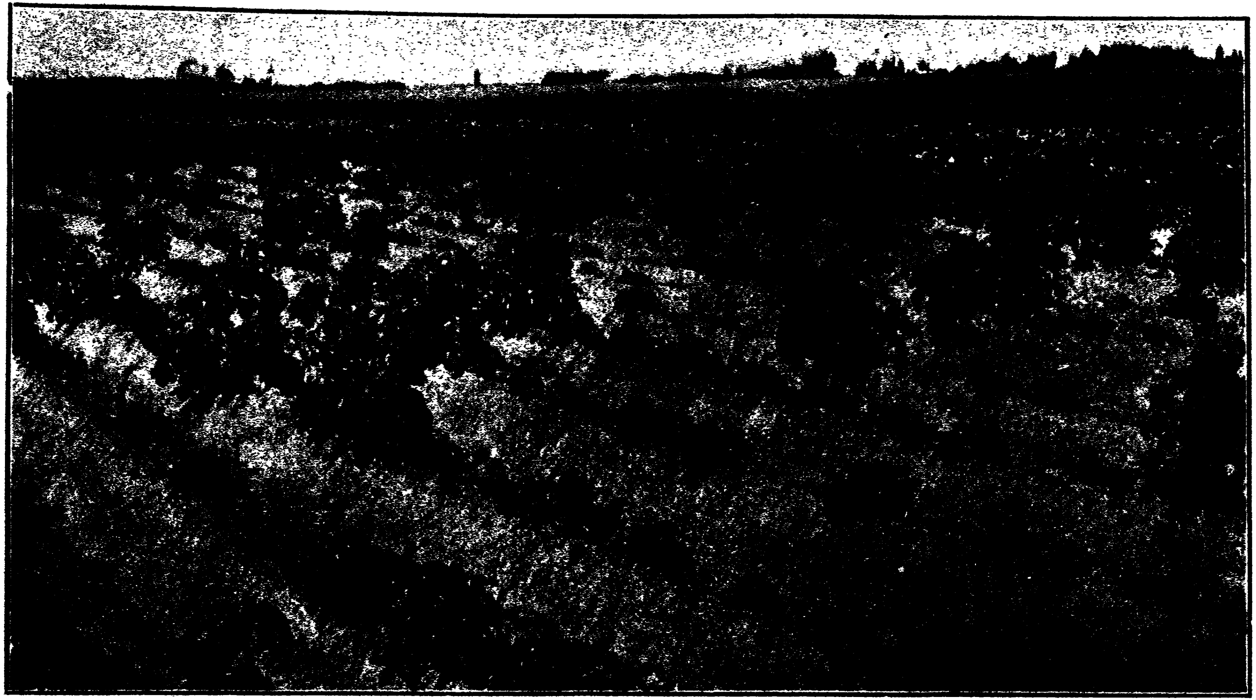


FIG. 7. A DEGENERATE LINE GROWING AT ASHBURTON EXPERIMENTAL FARM.

This seedling became infected with virus disease while being grown at the Moa Seed Farm, Central Otago, but, in common with a large number of other seedlings and commercial varieties, did not show these degenerate symptoms till transferred to Canterbury. In the 1926–27 season it was grown at Ashburton, and the illustration is of the 1927–28 crop. It will be seen that certain plants have evaded infection, and some selections of these made during 1926–27 have remained healthy. This is fortunate, because the seedling in question has very promising commercial possibilities. It is a case in which the early digging of single-plant selections affords the only hope of success.

[*Photo by H. Drake.*

blight. The stolons are long and the tubers large and coarse. Such plants should be rogued, for they represent an undesirable variation from the normal, more especially in an early variety such as Epicure.

Wildings: These plants are short, and produce an abundance of stems bearing no flowers. As might be expected, such a plant will produce a large number of seed-size tubers with few table potatoes, and the stock may deteriorate very rapidly. The variety grown under the name of White Beauty of Hebron produces a number of wilding plants.

One might be permitted here to say that there is no foundation for the oft-repeated assertion that the presence of rogues and variations is due to "inoculation by bees." Bees play no part whatsoever in this connection.

Potato Selection.

The potato is reproduced asexually from tubers, and the tuber is an underground stem which has been modified for the storage of food to be used by the plant during the early growth of the following season. One would not expect a rose-cutting to develop any variation from the parent plant, except in the very rare case of bud-mutation. Nor would one expect any variation to occur in the potato from one season to the next. So long as the plant remains healthy and in normal surroundings it produces indefinitely a replica of the original plant both in regard to appearance and cropping-power. Very occasionally bud-mutations occur, and may afford material for selection, but, as already stated, they are apt to be inferior to the parent variety.

One must conclude, therefore, that selection within a variety leads to no improvement; and such would be the case were it not for the fact that the potato will show great variation in degree of degeneracy, and therefore a corresponding degree of variation in cropping-power. A potato-field is populated with a number of individual plants, and even if all environmental variation is removed they will exhibit all degrees of cropping-power, depending upon whether or not disease is present. Upon this fact is based the whole principle of potato-selection, and it virtually becomes an evasion of those diseases causing degeneration.

It is at once apparent that selection must be made at a time when these conditions can be recognized—that is, during the growing season (Fig. 3)—and it is equally obvious that the selector must be able to recognize a degenerate condition when he sees it, which ability can be acquired only with experience. The tuber to be used for planting is the chief factor in distribution, for it carries the degenerate condition of its parent one step further (Fig. 4). It is also necessary to remember that these diseases are transmitted in the field by such agencies as the green aphis, and that a plant recently infected may show little or no symptom till the tubers are grown and the resulting plants inspected.

METHODS OF SELECTION.

There are two chief methods of selection, and it will be noticed that no reference is made to the hand-picking of seed after harvest, for this, although so commonly adopted, affords little or no selection whatever.

Mass Selection.—As the term implies, this is effected by collecting together a large number of individuals, and whether it is likely to be of any value will depend upon the standard of the individuals which comprise the mass. The least effective method is to earmark a section of the main crop for seed and to rogue all undesirable plants. The writer considers that rogueing, whether in potatoes or other crops, is a most ineffective means of cleaning up deteriorated stocks, and does not recommend it where other means are possible.

The use of cut table tubers has already been fully discussed in this connection, and needs no further comment beyond saying again that this method affords a very satisfactory means of effecting general improvement.

An improvement upon either method is effected by harvesting individual plants. It has already been stated that selection must take place when the rogues and degenerate conditions can be observed, and a commencement should be made during flowering. Armed with a number of sticks, the grower should go through his crop and mark as many "true to type" healthy plants as time will permit. These should be examined periodically till dug, and the stick removed if for any reason the original decision is reversed. It might be wise to mention again that "bolters," being more disease-resistant than their neighbours, are likely to appear promising in the eyes of any one not forewarned.

The marked plants should be dug in an immature state shortly after flowering and before the tops shows signs of maturing. They should then be greened, or stored in trays for greening and sprouting. By this means sufficient seed could be procured for the planting of a seed-production plot. The seed-plot should be isolated, and, as already mentioned, probably the worst location would be a few rows down the centre of the main crop.

This system of selection would appear to be the most effective for a practical grower to adopt, and if persevered with, and the seed plots carefully rogued, would undoubtedly repay him many times for his labour, and stimulate his interest and pride in his particular line

Individual Selection.—While bulk selection consists of bulking together the produce of a number of selected plants, individual selection may be described as the selection of individual plants, and by the growing and multiplying of these individuals determining with a greater degree of certainty that what appears healthy is in reality so and will produce healthy stock (Fig. 5).

In what is termed "hill selection" the tubers of an entire hill are planted out, and the produce of each is kept separate until such time as it has proved its merit. This method has been superseded by tuber-unit selection, in which one tuber from the selected hill is cut into four sets and the produce of each tuber kept separate as in hill selection.

Tuber-unit selection has many advantages over the hill method, but both are more within the province of the professional plant-selector. They are liable to fail if undertaken by a commercial grower, because of the slow increase, the large amount of detail involved, and the danger of reinfection resulting from insufficient isolation.

(*To be continued.*)

CRACKING OF DUNN'S AND COX'S ORANGE APPLES.

INVESTIGATION IN NELSON DISTRICT.

J. A. CAMPBELL, Director, Horticulture Division.

DURING the past few years fruitgrowers in different parts of New Zealand have suffered considerable anxiety and loss through the russeting and excessive cracking of certain varieties of apples, particularly the Dunn's and Cox's Orange varieties. In part of the Nelson District this condition appeared to be going from bad to worse each year. The Department of Agriculture and the Cawthron Institute were, naturally, called upon to institute investigations with a view to determining the cause of the trouble and methods of control. Early in the history of the trouble the Orchard Instructor at Mapua, Mr. B. G. Goodwin, gave growers very sound advice—namely, to thoroughly cultivate and manure their land, and to prune their trees severely with a view to getting rid of all weak and exhausted wood, to promote the formation of new growth, and to generally stimulate a more vigorous growth of the tree. The investigations carried out by the Biological Laboratory of the Department largely confirmed this advice.

Although the russeting and cracking referred to is still in evidence, a very marked improvement was noticeable last season where heavier pruning, &c., had been practised. In consequence of this the following questionnaire was issued in April last to those growers of the Nelson District who were held to be in a position to furnish information :—

(1) Have you experienced the russeting and cracking of Dunn's and Cox's Orange apples ?

(2) Does your experience suggest that it is due to a disease, or that it is physiological trouble arising from causes remediable by means of improved cultural methods ?

(3) If the former, on what do you base your opinion ?

(4) If the latter, is your opinion the result of actual practice ? If so, what cultural methods varying from those practised in your orchard previously have you adopted to overcome this ?

The following is a summary of the replies received :—

Twenty-one growers replied as having experienced cracking. Of these, nineteen are of opinion that the trouble is physiological, and two are of opinion that it is due to disease.

Of the nineteen who are of the opinion that the trouble is physiological, fourteen include hard pruning in their system of control. Of these, five mention hard pruning as the only special feature of orchard management necessary ; five add good cultivation and manuring ; three make the further addition of the use of non-caustic sprays ; while the fourteenth relies on hard pruning and the use of non-caustic sprays. Of the remaining five, one bases his success on cultivation and manuring only, another on the same plus the use of non-caustic sprays, while a third reports success through omitting bordeaux in the spring and the use of atomic sulphur plus lime-sulphur in the summer ; the remaining two report no success.

Growers Nos. 20 and 21, who blame disease, hold that it can be controlled, one by using Sulpho with lime-sulphur during the summer, and the other by hard pruning, good cultivation, and by adding plenty of plant food to the soil.

Notwithstanding the fact that the majority of the growers communicated with are of opinion that the trouble can be overcome by cultural means, continued close attention will be paid to the matter by the Department until this is definitely confirmed or otherwise. In the meantime the experience of growers, together with details as to experiments undertaken—whether successful or otherwise—if forwarded to the Department from time to time, will be appreciated.

BREEDING OF ROMNEY-CROSS SHEEP.

WALLACEVILLE WOOL-IMPROVEMENT DEMONSTRATION.

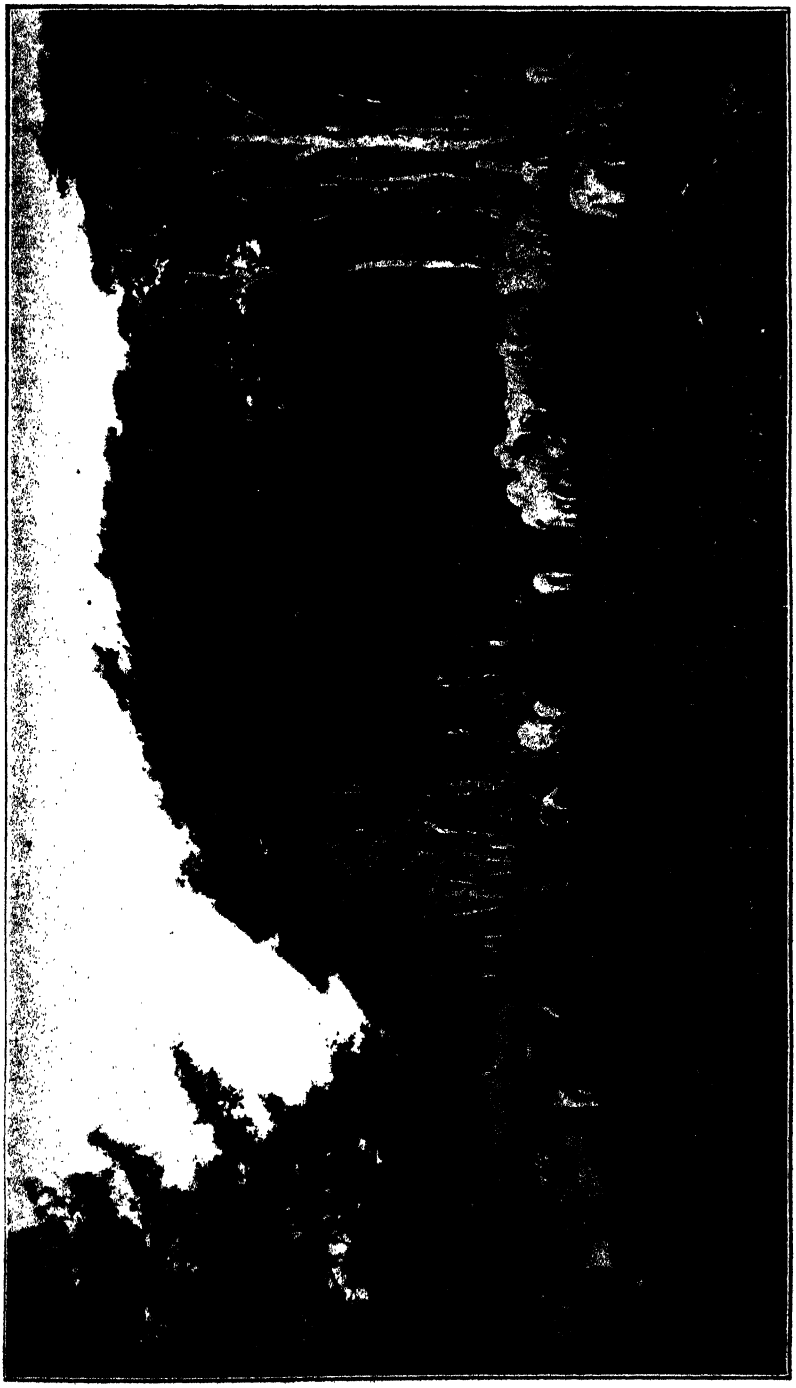
J. G. Cook, Wool Instructor, Live-stock Division.

In an article published in the *Journal* for April, 1925, the writer dealt with the improvement in wool fibre of a small flock of ewes at the Wallaceville Veterinary Laboratory Farm, near Wellington, when it was indicated that information in regard to further operations would be given at a later date. In the first place it may be mentioned that particulars have already been given as to the three successive Romney rams that were mated with the ewe flock in the period of five years covered. The third ram purchased was used for one year only, owing to the fact that he was not quite the type required.

During the sixth year (1925) another Romney ram was purchased at a cost of £12 12s. This animal was a late lamb, and it was anticipated that he would fill up well as a four-tooth. He had good conformation, constitution, and wool, but was inclined to be rather short in the leg. He did not grow to the height expected; nevertheless he produced some good stock, and his lowest lambing result was 124 per cent. This ram was retained for three years, mating him with the same ewes each year, no inbreeding being done the third year.

A Romney ram was generously donated to the Department early in the present year (1928) by a prominent sheep-breeder who is keenly interested in the work at Wallaceville. This ram has splendid constitution and conformation, with good wool showing character and density—very desirable features.

Throughout the demonstration only Romney rams have been used. Several objects have been in view—namely: (1) To show the improvement that can be effected in a rough cross-bred ewe flock when care and judgment are exercised in selecting the rams; (2) to keep the price paid for the rams at a moderate figure, within the reach of the average sheep-farmer (the average price for the rams purchased, transit charges included, amounting to £11); (3) to prove that a Romney ram carefully selected for purity of wool fibre can soon effect a marked change in the clip.



PORTION OF THE EWE FLOCK AT WALLACEVILLE LABORATORY FARM.

[*Photo by H. Drake.*

The following particulars summarize the later records similarly to the previous article :—

Year 1925: Ram No. 4 purchased. Constitution, conformation, and wool good; only fault rather short in leg. This ram was mated with the same ewes for the years 1925, 1926, and 1927.

Year 1928: Ram No. 5 has been used. It is intended to keep some of the ram lambs of his progeny, and sell them after they have been shorn as hoggets during November, 1929.

A small relevant experiment may be briefly recounted here. A statement was published in a foreign paper some little time ago to the effect that supposing wool growing on a sheep showed pith (hairiness) at the tip of the fibre, but such pith disappeared gradually lower down, leaving the remainder of the fibre pure wool, if the sheep was not shorn at the same time in the following year then the fibre would revert back. In effect this means that the pith would appear and disappear at the same time each year. In order to ascertain whether this hypothesis could be proved arrangements were made for six of the older ewes and four of the hoggets in the Wallaceville flock to be left unshorn at the general shearing during November, 1927. They were shorn towards the end of March, 1928, when the ewes were carrying sixteen months' and the hoggets eighteen months' growth of wool. One of the ewes was six years old, and was of the progeny produced by the first Romney ram used. In the previous year the breech wool of this ewe had been showing signs of going back—that is, part of it down the hind legs was showing hairy wool tendencies. She was kept to see if any further retrogression took place in that portion of the fleece. The lower part of the breech wool had some fibres in it showing pith at the tip, but this pith disappeared as one examined down the length of these fibres, the rest being pure wool. In no instance was it noticed that the fibres reverted back to the pith appearing at the same time as during the previous year. The ewes and hoggets whose wool was pure at the tip had pure wool at the base of the fibres, irrespective of their length or the time the wool had been on the sheep. It may be mentioned that this wool was sold at the Wellington sale on 26th March last, and realized up to 23½d. per pound.

The operations recorded in this and the previous article have proved to be a very interesting study. The line of breeding, selection and mating, degree of culling, fertility of the soil, palatability, of the pasture, climatic conditions, lambing, dipping, and other matters entailed in the management of a flock all enter into consideration in such work. Sheep-farmers out to improve their flocks intelligently on similar lines will find the time and thought involved well spent.

Insect Parasite of Piripiri.—With reference to the note by Mr. D. Miller on this matter in last month's *Journal*, further communications have been received by the Noxious Weeds Control Committee from Brother Claude Joseph, in Chile. He emphasizes the great vital resistance of the larva and the fact that, as it can feed on any species of *Acaena*, it would probably adapt itself to New Zealand conditions. The species hibernates in the larval stage buried in the ground, a circumstance which would make transit to New Zealand easy.

SURVEY OF DISEASES OF CEREALS IN NEW ZEALAND.

J. C. NEILL, Field Mycologist, Plant Research Station, Palmerston North.

Diseases of Wheat.

RUST.

Two species of rust are present on wheat in New Zealand—brown or blade rust (*Puccinia Elymi*) and black or stem rust (*Puccinia graminis*). Of these the former appears earlier in the season and is more generally present, over 90 per cent. of the crops examined in 1926–27 being infected. As a rule the infection was light, but in favourable localities and seasons very heavy infection occurred. The season 1927–28 was not favourable for rust development, only 26 per cent. of the crops examined in Canterbury showing infection, and that rarely more than a trace. Black rust (*Puccinia graminis*), judging by the survey data over the last three seasons, is not a very serious disease of wheat in New Zealand. Where present it has appeared only on crops almost fully mature, and it is possible that some crops which were apparently free at the date of inspection showed later the presence of the disease. In 1926–27—a year favourable to rusts—18 per cent., and in 1927–28 5 per cent. of the crops examined in Canterbury were infected, and in no case was the infection severe.

SMUT.

Two types of wheat-smut are present in New Zealand—stinking smut (*Tilletia Tritici* and *Tilletia levis*), and loose smut (*Ustilago Tritici*). The former is generally present to a small extent in a few crops in every district, but its incidence is slight, owing to the almost universal adoption of seed-disinfection. Loose smut varies in incidence according to the variety of wheat. Hunter's wheat, practically all of which is now College Hunter's—that is, the product of the Canterbury Agricultural College selected strain—is invariably free from infection. Velvet Chaff only rarely shows a trace of infection, though the variety Velvet Ear or Solid-straw Velvet, largely grown in South Otago, always shows from a trace to 3 per cent. of loose-smutted heads. Solid-straw Tuscan, comprising 75 per cent. of the wheat grown in New Zealand, shows in general a small percentage of infection, as a rule less than 1 per cent., but in occasional crops rising as high as 8 per cent. From the data collected it appears that loose smut is slowly but steadily increasing in Solid-straw Tuscan throughout the country. The other long-berried wheats commonly grown—White-straw Tuscan, Purple-straw Tuscan, Dreadnought, and Major—all show a very definite percentage of the disease. White-straw Tuscan in particular is invariably heavily infected, smutted heads varying from 6 per cent. to 24 per cent.

TAKE-ALL (*Ophiobolus graminis*).

This disease appears to be the most serious disease of wheat in New Zealand—judging at least by last season's survey. A careful and conservative estimation, based on the crops examined, puts the direct average loss for New Zealand at 5·5 per cent. All varieties appeared

equally susceptible to the disease, but in certain localities, such as North Canterbury and North Otago, its incidence was more pronounced.

WHITE-HEAD *(Cause not yet determined).*

This condition was observed in many crops, but, except where take-all was in evidence, rarely was more than a small percentage of the heads affected.

MILDEW *(Erysiphe graminis).*

Mildew is generally present on wheat in New Zealand, but only when climatic and other conditions are particularly favourable does its incidence become severe.

SCAB *(Gibberella Saubinetti).*

Like mildew, this disease is generally present to a slight extent on New Zealand wheats. Occasionally a crop, or portion of a crop, is met with that shows severe infection on every head, but the conditions which determine this or the loss it causes are points that are still obscure.

Table 1.—Percentages of Wheat Crops examined which showed Infection by respective Diseases.

District.	Number of Crops.	Brown Rust.	Black Rust.	Loose Smut.	Stinking Smut.	Take-all.	White-head.	Mildew.	Scab.
				1925–26.					
Marlborough	18	72	11	72	5	0	0	0	..
Canterbury	198	49	0·5	36	3	9	45	8	..
Otago ..	38	16	2	50	2	0	0	8	..
Southland ..	10	0	0	60	20	0	0	0	..
				1926–27.					
Marlborough	33	91	0	85	0	12	0	0	0
Canterbury	430	96	18	30	6	13	30	7	26
Otago ..	37	80	73	51	11	16	0	35	70
Southland ..	11	91	45	91	36	72	0	27	9
				1927–28.					
Marlborough	51	86	2	82	2	20	33	23	2
Canterbury	547	26	5	53	9	37	42	90	87
Otago ..	62	53	19	64	14	35	27	50	71
Southland ..	19	21	0	100	42	47	47	26	84

Diseases of Oats.

RUST.

Two species of rust are present on oats in New Zealand—crown or blade rust (*Puccinia coronata*) and black or stem rust (*Puccinia graminis*). In the South Island (no survey has been made of the North Island oats) the former predominated in the rust-favourable 1926–27 season, while in 1927–28 only a trace was observed in a few crops, and in several localities it was absent altogether. Even when commonly present, as in 1926–27, the amount of leaf-surface affected by the rust was rarely high. Black rust, on the other hand, in 1926–27, in certain localities, and especially in late-maturing crops, was very severe in its incidence,

every part of the plant, leaf, stem, and head being covered by the rust pustules. In 1927–28 only very rarely could more than a trace be detected, and many localities were free from infection altogether.

SMUT.

Two species of oat-smut are present in New Zealand (*Ustilago Avenae* and *Ustilago levis*), but, since accurate differentiation in the field is difficult, and their life-histories, effects, and methods of control are similar, they are considered here as one. Smut is common in New Zealand in all districts and on all varieties of oats, with the partial exception of Algerians, which are seldom heavily infected. The loss caused by the disease has been very greatly reduced during the last two seasons, except in the Marlborough District, owing to the more general adoption of seed-disinfection. This reduction is much greater than the tabular presentation of the survey results would indicate, since, though the current methods of seed-disinfection reduce the amount of smut to small proportions, disinfection of infected seed is rarely complete.

LEAF-SPOT (*Septoria gramineum*).

This disease is present on most oat crops in New Zealand, but the lesions rarely occupy more than a small proportion of the leaf-surface. It is more prevalent in wet localities.

WHITE GLUME.

This condition, probably of physiological origin, is fairly common on Garton and Sparrowbill oats, but rare on Algerians and Duns. Only occasionally does it appear to cause any material reduction in yield.

Table 2. Percentages of Oat Crops examined which showed Infection by respective Diseases.

District.	Number of Crops.	Crown Rust.	Black Rust.	Smut.	Leaf-spot.	White Glume.
			1925–26.			
Marlborough ..	12	0	17	17	0	0
Canterbury ..	91	3	1	65	27	0
Otago	100	1	0	88	0	0
Southland ..	110	1	0	90	0	0
			1926–27.			
Marlborough ..	52	25	21	46	23	0
Canterbury ..	256	43	40	93	72	45
Otago	129	85	61	90	83	73
Southland ..	115	90	84	90	90	88
			1927–28.			
Marlborough ..	104	15	21	50	72	25
Canterbury ..	246	5	25	66	93	69
Otago	94	15	46	72	73	54
Southland ..	116	0	45	87	89	7

Diseases of Barley.

RUST.

Only one species of rust (*Puccinia anomala*) is present on barley in New Zealand. The season 1926–27 was a favourable one for rust development, and the large majority of barley crops were affected, though infection was not often severe. In 1927–28 infection was much less in Marlborough, and practically absent in Canterbury and Otago.

SMUT.

There are two species of smut present on barley in New Zealand—Covered smut (*Ustilago Jensenii*) and loose smut (*Ustilago Tritici*). Until the last two seasons the former smut has been very common in New Zealand barleys and the cause of very serious losses. The growing of malting-barley of late years, however, has been largely controlled by the commercial interests interested in the product, and this has resulted in great attention being paid to efficient seed disinfection and selection. The consequence has been that the loss from covered smut in malting-barley last season was practically nil, the few crops still showing its presence having in no case more than a trace. The position, however, is very different in the case of feed barleys, which are not controlled, and which, moreover, are often originally intended for feeding-off green and allowed to mature for harvest as an afterthought. These barleys are almost invariably smutty, and provide a constant source of possible reinfection—through threshing-mills and cleaning plants—of the clean malting-barleys. Loose smut has not been observed during the past two seasons on any malting-barley in New Zealand. Feed barleys, especially the variety Russian Cape, are usually infected.

TAKE-ALL (*Ophiobolus graminis*).

This disease was observed in a few crops only.

WHITE-HEAD (*Cause not yet determined*).

This condition, which is usually associated with fungus attack at or below ground-level, is often present in New Zealand barley, but seldom affects more than a few isolated heads in the crop.

MILDEW (*Erysiphe graminis*).

Mildew was present in a few crops during the last two seasons, but its incidence was never severe.

STRIPE (*Helminthosporium gramineum*).

This disease was observed on almost all barley crops in 1927–28. In most cases the only symptoms observed were small but characteristic lesions on the lower leaves, a character not recognized as diagnostic during the previous year's survey (thus accounting for the apparent large increase in incidence shown in the table). In some crops, however, and particularly in Cape barley, the disease became more severe in its attack, resulting in many shrivelled and distorted heads.

Table 3.—Percentages of Barley Crops examined which showed Infection by respective Diseases.

District.	Number of Crops.	Rust.	Covered Smut.	Loose Smut.	Take-all.	White-head.	Mildew.	Stripe.
			1926–27.					
Marlborough ..	49	87	51	2	0	5	2	36
Canterbury ..	69	95	72	6	6	2	3	7
Otago ..	19	84	47	16	0	21	0	26
			1927–28.					
Marlborough ..	24	66	9	4	8	66	4	79
Canterbury ..	114	3	41	2	9	47	12	92
Otago ..	22	0	41	0	0	23	0	95

CROW GARLIC AND ITS CONTROL.

STUDY IN WAIKATO DISTRICT.

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Crow garlic (*Allium vineale*) is by no means a common weed in New Zealand, yet wherever it makes its appearance on grassland it should be regarded as an intruder and serious efforts should be made to eradicate it. Like all members of the onion family, this weed has a characteristic penetrating odour, and it requires no effort of imagination to suspect it capable of tainting milk and cream from cows pastured upon it. In the Cambridge locality, where the matter was studied, it is usual for certain farmers to receive complaints each autumn and spring regarding tainted milk sent forward to the factories. Several of these farmers were visited and the garlic studied on their farms. The suggestions which follow are therefore based upon local conditions in the Waikato.

It will be well to give a short life-history of this weed before proceeding to deal with those factors which are important in its control and ultimate suppression. The "seed-heads," which appear in December, are borne on an elongated stalk some 3 ft. to 4 ft. high. These seed-heads are really clusters of small bulbs or "bulbils." At first these are enclosed in a filamentous covering, which bursts as the bulbils ripen and swell. At the end of December the bulbils are ready to drop off, and those that find congenial surroundings almost immediately take root. By March the young plants are well established. The bulbils may fall into drains and be carried a long distance by the water before being arrested. The spreading of crow garlic in the area studied has largely been effected in this way. The garlic can be readily pulled by hand just at that stage when the bulbils are ripening and have burst their filamentous covering. The parent bulbs in the ground are then quite close to the surface, and the seed-stalk is quite woody and does not break in the hand.

The accompanying photograph (Fig. 1) shows the ripe seed-heads. The bulbil clusters can be seen at the top. Those on the right are

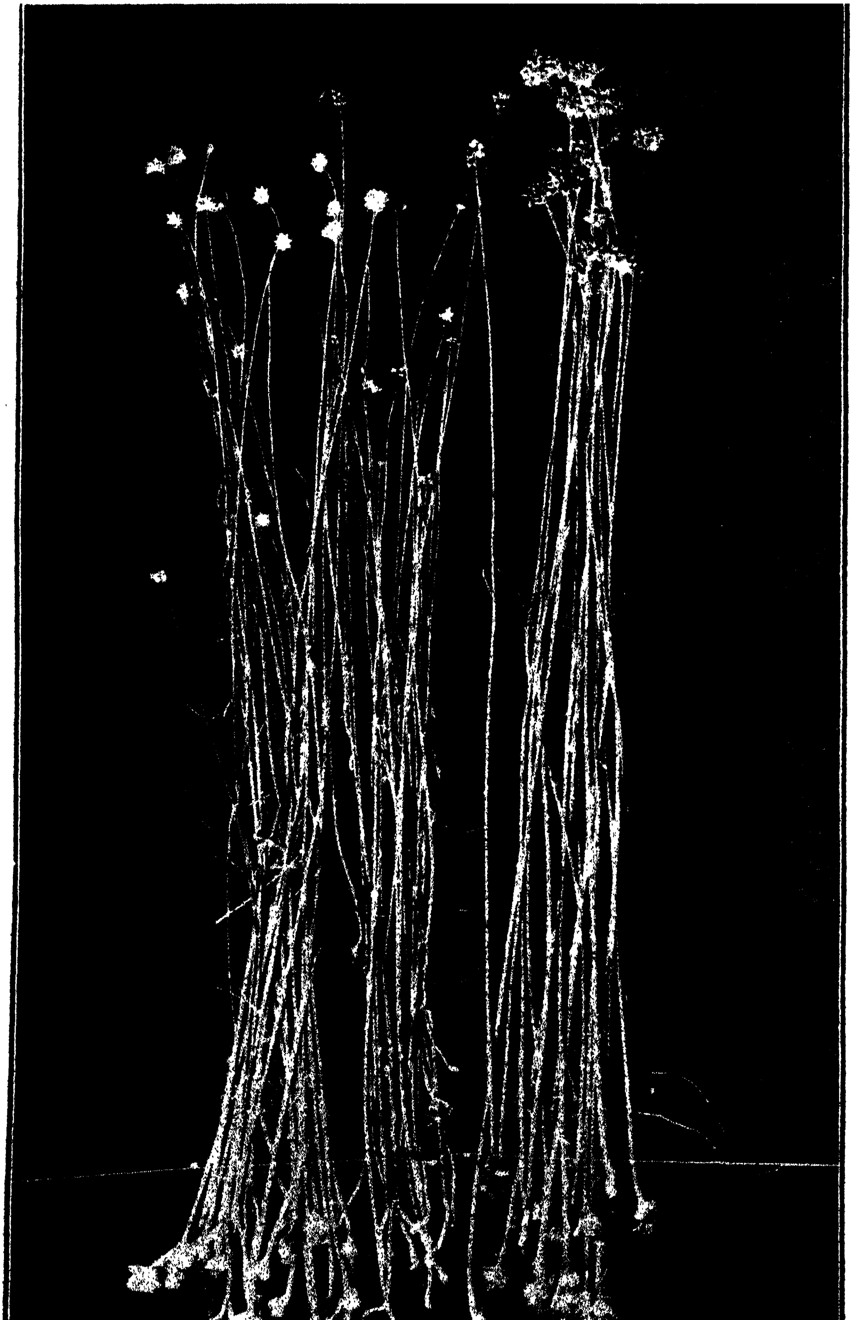

FIG. 1. CROW GARLIC, SHOWING BULBS AND RIPE "SEED-HEADS."

barely ripe, while those on the left are at the best stage for pulling by hand. In both these groups the parent bulbs can be seen at the foot, also small attaching bulbs which often split off and so propagate afresh. No matter how carefully the pulling is done, many of these split bulbs will be left in the ground. This propagation from split bulbs, as well as from the prolific crop of bulbils on the seed-stalk, makes crow garlic a most troublesome weed to deal with. The central group in the photo was pulled by hand from a patch that had been sprayed by an arsenical compound. The bulbils are largely withered and dead. The parent bulbs are also shrivelled, but in pulling the split bulbs have all been left in the ground, as the parent bulb has shrivelled away from them. Split bulbs will grow and reproduce fresh plants, as shown diagramatically in Fig. 2.

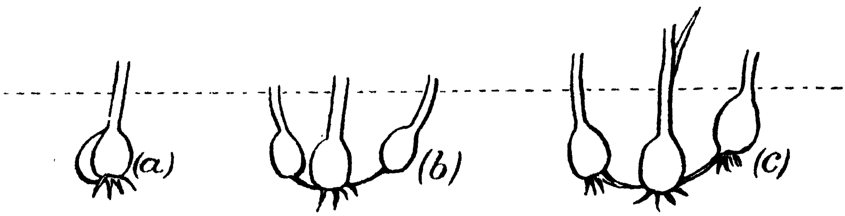

FIG. 2. SHOWING REPRODUCTION OF CROW GARLIC BY "SPLITTING" OF BULBS.

(*a*) Splitting commenced; (*b*) new bulbs formed; (*c*) new bulbs forming roots and leaves.

During the investigation four different spray compounds were used in an endeavour to kill off the garlic, two being non-poisonous sprays and two arsenical compounds. After three sprayings, with uncertain results, the work was discontinued, as the cost had become prohibitive. The young establishing plants were killed out to a large extent, but apparently the mature bulbs were only affected at seeding-time, with the result seen in Fig. 1. In these cases also the split bulbs were not affected, and so could propagate anew.

From a study of the weed in the field, however, it seems certain that control and absolute prevention from spreading can be obtained by controlled stocking with cattle and sheep. Crow garlic flourishes along headlands, hedgerows, drains, &c.—wherever there is ungrazed land or where cattle have only occasional access. Furthermore, in those instances where the garlic had spread to the surrounding grassland it was found that this pasture had not been top-dressed with artificial fertilizers, and had been grazed only on odd occasions. In the dairying district studied, it was usual to find the garlic along the headlands, &c., and even a few feet inside in the pasture, but not farther than the limit imposed by the top-dresser. This clearly points to the fact that its further spreading into the pasture was prevented by the stock grazing on the sweet top-dressed area. Even if the garlic had appeared in the pasture, the constant browsing by the stock and the heavy tramping received had clearly crushed it out.

From the life-history given it will be seen that garlic-infested land should be heavily stocked by sheep or cattle when the young plants are just establishing and tender. This is during February and March

in the Waikato. If the land is used for dairying there is a likelihood of milk tainting at this time, so that sheep or dry cattle should be brought to bear on the infested areas. As the garlic appears only in waste places in the locality studied, these places must be top-dressed to induce stock to seek their food there. Such manures should therefore be applied in early February, as soon as rains have fallen. The pasture should then be grazed heavily as soon as possible. Usually this top-dressing will have to be done by hand to be effective. It should also be liberal—in fact, the infested areas manured more heavily than the adjacent garlic-free pasture. Where a high hedge shelters the garlic it may pay to trim this down and let in the sun to sweeten the grass below. The rank grass under tall shelter is never so acceptable to stock as the sun-exposed open pasture.

During June and July the whole herd can be brought to bear upon the infested areas, and it is during these months that garlic is especially vulnerable. During spring, when dry stock only can be used, it may be necessary to scythe the infested areas until December, after which practically no growth is made until autumn. On no account should garlic be allowed to seed. The feeding-out of hay, ensilage, &c., along garlic-infested areas is not advised, for although the land will be the more heavily tramped it will also be fouled, and the same hard grazing by the stock will not be attained. That systematic grazing and spelling of pastures is the only successful way to manage grassland will be admitted by every thoughtful dairy-farmer. Weeds of all kinds flourish on the neglected headlands ; on the other hand, as the pasture is built up by complete artificials, efficient management by systematic grazing and spelling, and the right use of the tripod harrows and mower, so the rye-grass-dominant sward comes in to oust these weeds. Garlic can be added to the long list of weeds that will not survive under intelligent grassland management.

If garlic is infesting intercultivated crops on arable land, careful hand pulling in December should follow the thorough intercultivation given up to that time. All the pulled material should be burnt, as garlic does not wither away in the sun. If possible the land should be laid down to permanent grass in February. The seed-bed should be rolled and well compacted, and liberally manured to force on the young pasture. The more weedy the land, the heavier should be the manuring for grassland when it is establishing. As soon as possible dry cattle or big mobs of sheep should be pastured on the field. This should continue until the dairy herd is available for grazing the pasture from June onwards. It is useless to close such a pasture for hay, as the garlic seed-heads are ripe at haying-time. Provided the making of early ensilage is certain, then the field can be closed to stock, but it must be harvested in early November. Only the leaves of the garlic-plant will be obtained in this ensilage, and the fermentation processes set up in the silage pit or stack will largely render innocuous the pungent material. After the mowing of the field at this stage the garlic will make no growth until the following February, so that in the interval systematic stocking can be brought to bear upon the area, and thus the "aftermath" will be closely grazed. This systematic grazing must be followed up during March when the young plants are just appearing.

STRAWBERRY-GROWING IN NEW ZEALAND.

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VARIETIES.

THE varieties of strawberry grown are innumerable, as the plant is readily raised from seed. It is not intended, however, to give a complete list or even a description of all well-known varieties in this article, but rather to deal with those that are grown commercially in New Zealand.

In most parts of Auckland Province the Marguerite is the principal one grown commercially. The berry resembles a blunt wedge in shape, and grows larger than most other varieties. When ripe the flesh of the berry is extremely soft, and therefore it cannot be considered a good carrier, being very susceptible to bruises. Its flavour is not equal to the best, but this fact is largely lost sight of by the average consumer, as the excellent appearance more than compensates.

In the extensive strawberry-gardens of Nelson and Hawke's Bay Provinces the Melba variety predominates. The fruit is considerably smaller than that of Marguerite, and is conical in shape. It is superior to Marguerite in flavour and equal in firmness.

The Etesburgh variety is not uncommon in parts of the South Island, but is seldom found in the North Island, though it has been tested in most localities and in various soils. The berry is spherically shaped and is smaller than Melba. The flesh has a very firm texture, and therefore carries well. The flavour resembles that of a pineapple, and must be considered excellent.

A well-known English variety, the Royal Sovereign, is sometimes met with in New Zealand gardens, principally in the South Island. While the flavour and size of this berry leaves little to be desired, it is not grown extensively, principally because it is not a heavy cropper in most strawberry-growing localities.

A variety that has of recent years made its appearance on the Auckland markets is Captain Cook. In appearance, texture, and flavour this fruit is very similar to Melba, and when better known may become a very popular strawberry. The fruit ripens slightly earlier than Marguerite, and plants give better results than the latter variety when retained for the second season.

The Everbearing is another variety that is seldom seen in our markets, but which appears to have outstanding qualities when grown under suitable conditions. The fruit is almost equal to Marguerite in size, and quite equal in flavour and texture. The class of soil best suited to the Everbearing appears to be a light sandy loam, which is unsuitable for many other varieties.

Laxton's Noble is giving good results where grown in the southern parts of the South Island, and is gaining popularity there on account of its size and appearance. The fruit resembles in many ways that of the Marguerite.

Many other varieties of strawberries can be found growing in New Zealand, but none are of sufficient commercial importance to warrant

a description here. Of the seven varieties named above Marguerite and Melba surpass all the others as regards the quantity grown, consequently the remarks which follow will principally treat with those two varieties. It can be generally taken that Marguerite is the principal strawberry grown in Auckland Province, and Melba in the more southern districts. However, a fair quantity of Melba has been grown in Auckland of recent years, and the variety is reported to be giving satisfactory results.

SITE AND SOIL.

In selecting the site for a strawberry-garden it must be remembered that the earlier in the season the fruit ripens the greater the price that fruit will command on the markets. Consequently it is best to choose a warm site, preferably with a gentle slope towards the north or north-east, and well protected from cold winds.

Both the Marguerite and the Melba varieties will give excellent results when grown in a friable clay loam with a porous subsoil. However, they are not exacting, and many other classes of soil will often give results that leave nothing to be desired. Most varieties will not thrive satisfactorily on a very light or sandy soil.

CROPPING-HABITS.

Strawberry-plants have been known to survive for a period of ten years without transplanting, and when transplanted every alternate year will often endure for several years longer. For commercial purposes the life of a plant may be considered as not more than three years. Variety, soil, and certain pests and diseases are all important factors in determining the profitable period. In Nelson District plants of the Melba variety can usually be left unmoved to advantage for a period of three years from the time of planting; but only in most exceptional cases, when the plants show particular vigour, will it be found profitable to allow them to remain for a fourth season. In gardens where the majority of plants have made poor growth during the first season after planting, or where diseases or pests have appreciably reduced their vigour, it is unwise to allow them to remain for the third season's crop. Most of the successful growers in Auckland Province consistently replant their gardens every season. Some growers in the district have been known to allow their plants to remain unmoved until after the second season's crop has been harvested, but the result in almost every case has been small-sized fruit.

Blooms are frequently produced in the winter and early spring months before the young plants have grown sufficient new roots to become firmly established. These blooms should invariably be removed as soon as they appear.

The Melba variety usually ripens its first fruits of the season at the beginning of November. This date, however, may vary as much as ten days either way, according to seasonal conditions and locality. The crop usually continues until about the third or fourth week in December, and sometimes later in the southern provinces. When a very dry season is experienced the cropping period may be shortened by two weeks. Melba invariably produces a second crop annually, which commences to ripen about the first week of February and often continues

until April. While the second crop is spread over a much longer period than the first, and the fruit is usually of a superior size and flavour, the quantity produced is considerably less than in the first crop. When a very dry summer and autumn are experienced, the lightness of the second crop may make the gathering so expensive as to reduce the net value of the crop to a negligible amount. When a wet summer and autumn are experienced the second crop may be expected to yield more than half the amount of the first.

The Marguerite variety yields only one crop annually, and the period over which this extends is usually from one to two weeks longer than that of the first Melba crop. The first berries to ripen will generally be a few days later in the season than with the other variety. The quantity of fruit produced by Marguerite compares more than favourably with the quantity of the main Melba crop, and frequently equals as much as both of the Melba crops combined. In this connection it should be noted there are many different strains of Marguerite, some producing far less fruit than others. Therefore growers when purchasing plants should exercise the greatest care to secure plants known to be of the best strain.

PLANTS.

When a young plant is first set out it is approximately six months old and has a single crown. During the first season after planting out, this nucleus crown not only increases in size but also produces many other offset crowns which cluster round the parent plant. A strong-growing plant will sometimes produce as many as twelve or more crowns during the first season ; six to eight crowns is considered a good average two-year-old plant. Growers sometimes follow the practice of breaking up the crowns of the previous year's plants and replanting them as they would a young plant. These second - year plants, as they are termed, often thrive well and yield a fair crop of fruit, but must be considered inferior to young plants ; therefore this practice cannot be recommended.

In the suburbs of Auckland City, which are noted for the quality and quantity of strawberries produced annually, young plants are almost invariably used. These plants are not raised by the growers of the fruit, as it has been amply demonstrated that plants raised in other parts of the province invariably give better results. This is due principally to the fact that most of the Auckland berries are grown in a heavy clay soil, which produces excellent fruit but is not suitable for the raising of plants. A lighter soil that will not retard the root-growth of young plants is more suitable for this purpose. Strawberry-growers in the South Island almost always themselves grow the plants they require from year to year, there being no special advantage in introducing plants from other parts.

PLANTING.

Planting is best done in the autumn, sufficiently early to give the plants time to send out young fibrous roots before the cold and wet winter months stop all growth. The only exception to this is when the land to be planted is likely to be saturated with water for any appreciable length of time during the winter months, a condition which is unsuitable for strawberry - growing. When circumstances prevent

autumn planting this work is best delayed until shortly before the plants commence growth in the spring. This is most important in localities where severe frosts are experienced. When new roots have not been formed before the dormant period the freezing of the surface soil will draw the plants partially out of the ground unless very firmly and deeply planted.

Rows should be spaced 3 ft. apart where horse-drawn implements are to be used in cultivation Where hand cultivation is to be practised a distance of 2 ft. 6 in. between the rows is sufficient. In both cases the plants should be set out from 6 in. to 9 in. apart in the rows. The double-row system of planting is practised by some growers, and with fair results. This system is to have a wide and a narrow alley respectively between each alternate row, the width of the former being 3 ft. and of the latter 1 ft. 6 in. This method has the advantage of allowing a greater number of plants per acre than with the single-row system, and more than half the ground can be cultivated by horse-drawn implements. This practice cannot be recommended for stiff clay soils, however.

In preparing ground it is most important that all weeds should be buried deeply or worked out of the surface soil before planting is commenced. Sorrel and couch-grass are especially to be guarded against in this way, for if these weeds become entwined about the crown of a plant it is often impossible to remove them without causing serious damage. From 3 in. to 4 in. of this surface soil should be worked to a fine tilth, and should then be smoothed and pressed ; a horse-drawn clod-crusher serves this purpose admirably. This work must be done only when the land is reasonably dry, otherwise the horses' feet and the weight of the crusher will make the ground too firm for planting. If the ground is not pressed before planting it will be found that after the land has been tilled for a few months the frequent walking and cultivating between the rows will cause that part to sink, leaving the soil round the plants from 1 in. to 2 in. higher than the remainder of the plantation. Where this condition prevails the plant will feel the effect of the dry summer weather much more than it would if the surface of the soil was even. In small plots it is a good practice to dig in a heavy dressing of stable manure or other vegetable matter as deeply as possible when preparing the ground for planting. This assists in procuring better drainage and a warmer soil, with consequent better results.

A 14-gauge wire makes an excellent line for marking out the rows. When the wire is in position the wheel of a hand cultivator should be run along the line, and it will be found that the wire makes a sufficient indentation in the soil to be really seen. The wire can then be removed and the planting-furrow made. A Planet Jr. machine with hand-plough attached is most suitable for this purpose. In planting, the roots should be well spread. The soil requires to be firmly pressed around each plant, and the plant should be placed at sufficient depth so that the top of the crown is level with the soil surface. In soils of a very light and porous nature the crown should be slightly below the soil surface, a depression being left round the plant so that the crown will not be completely covered. For small plots the use of a hand trowel can be recommended for planting in place of the machine.

CULTIVATION.

The strawberry is a plant that requires abundant moisture during the summer and autumn months if a long cropping-period is to be maintained. With this object in view the ground should be kept in a fine state of tilth until the mulch is laid, so as to conserve the soil moisture and to give the air access to the soil round the plant-roots.

Owing to the strong-rooting habits of the plant, deep cultivation is not advisable in close proximity to the foliage, otherwise valuable feeding-roots will be destroyed. Adjacent to the plants cultivation should be maintained to a depth of from 1 in. to 1½ in., which will prevent the roots from coming too close to the soil surface, as they invariably will if not kept down by constant cultivation. When the roots are close to the surface the plants are more susceptible to acute changes of temperature and moisture, consequently this condition should be carefully guarded against. Where rows are planted at a sufficient distance apart to allow the use of a horse-drawn cultivator, the ground should be tilled to a depth of 4 in., care being taken that the implement does not come within 9 in. of the plant on either side. Where hand cultivation is practised it would be too expensive an undertaking to keep the soil tilled to this depth, therefore mulching must be relied on to conserve the soil-moisture. A suitable horse-drawn cultivator for this work is one made in the shape of the letter V, and with which the angle can be readily adjusted to suit requirements; a row of very narrow tines, each 9 in. long and not more than ½ in. wide, to be fastened at equal intervals along each side of the V.

MANURING.

Strawberry-plants respond readily to fertilizers, and in many of our most profitable gardens a payable crop could not be harvested without the application of some form of manure. The quantity and class of manure to be applied must necessarily vary considerably according to the class of soil to be treated. Many growers in the vicinity of Auckland City apply annually 3 tons of mixed fertilizers per acre. Most South Island growers do not apply more than 1½ tons of mixed fertilizers. Nitrogen should be added to the soil, but only in such quantities as will stimulate the growth of the plant without causing excessive leaf-production. An excess of nitrogen will produce an abundant leaf-growth without a proportionate fruit-production. The use of phosphatic fertilizers alone will produce an excess of fruit for the size of the plant, and will not stimulate the growth of the plant sufficiently to give the greatest production of large-size fruit. Hence a combination of phosphate and nitrogen is necessary in order to obtain maximum results; when phosphate is in excess of nitrogen a firmer fruit will be produced. In addition to nitrogen and phosphate, potash should also be applied to most soils.

Nitrate of soda can be used to advantage when the fruit is maturing, or as a spur to lagging growth early in the spring. When the growth is normal nitrate of soda should not be applied until the earliest berries have attained at least half their mature size, as this fertilizer tends to produce a too luxuriant leafage and also detrimentally affects the texture of the fruit. Three applications at fortnightly intervals are desirable. When the weather is dry nitrate of soda may be given in

liquid form. The proportion recommended is 1 oz. to 2 gallons of water, giving from 1 to 1½ pints to each plant.

When land is to be planted during the month of May it should be given a final ploughing about two weeks before planting. Where cover-crops have been grown the ploughing should be several weeks earlier. Immediately prior to this ploughing manure—either organic manure or artificial fertilizers—should be applied evenly over the entire ground-surface. Before planting, fertilizers can, in certain classes of soil, be sown in the small furrows that have been made to receive the young plants. As soon as the heavy winter rains have passed, and before the plants break into new leaf, a third application of fertilizers is desirable. With varieties that produce a second crop annually, such as Melba, fertilizers should be distributed around the plants immediately the early season crop has been harvested.

Many different classes of fertilizers are being used throughout the Dominion by strawberry-growers, and with varying degrees of success, but blood-and-bone, superphosphate, sulphate of potash, Peruvian guano, and nitrate of soda usually give the best results. The following manurial scheme must be taken only as a basis on which to work out individual programmes, for as soils vary so must the manurial programme vary if the greatest success is to be obtained. The figures given are for an area of 1 acre.

When applied.	Blood-and-bone.	Super.	Sulphate of Potash.	Guano or Nitrate of Soda.
	Cwt.	Cwt.	Cwt.	Cwt.
(1) Before planting	8	8	2	..
(2) At planting	3	3	..	..
(3) In early spring	8	8	2	..
(4) Immediately prior to mulching	..	..	..	2
(5) After early season's crop is harvested, and when an autumn crop is expected	6	6	..	..

When application No. 5 is necessary, Nos. 1 and 3 may be reduced proportionately so that the total will not be increased. In an established garden Nos. 1 to 3 inclusive should be applied together in the early spring. In certain clay soils No. 2 will cause a severe burning of the roots, and in localities where this trouble is experienced an application at the time of planting should be postponed until the first cultivation after planting.

No matter what quantity is applied, artificial fertilizers will not fully compensate for a lack of humus in the soil; therefore it is essential to success that humus be supplied in some form or other. The ploughing in of a cover-crop serves this purpose satisfactorily. Leguminous plants are to be recommended, especially blue or white lupin, which should be sown with 4 cwt. of superphosphate per acre. When stable or farmyard manure is available at a reasonable cost, however, it should be always given preference. When a heavy dressing of natural manure is given the application of nitrogenous artificials should be proportionately reduced.

The strawberry is a plant that is considered to require an acid soil, consequently lime should not be applied, nor any special treatment given to sweeten the soil, except that the ground should be kept fallow during the summer and autumn months prior to planting.

RUNNERS.

Runners are usually produced in abundance on first-year plants, and if allowed to remain the growth of the parent plant will be considerably retarded, and will yield a proportionately small quantity of fruit if they are retained for the second season. Where new plants are required a sufficient number of first-year plants should be set aside for this purpose. These plants had best be prevented from fruiting; this will more than double the number, and greatly increase the size and vigour of the runner plants. It is worthy of mention that plants produced early in the season invariably give better results when planted out than plants produced in the late summer and autumn months, as the crowns of the latter are not sufficiently matured. The cutting-off of the spring blooms stimulates the production and growth of runners early in the season. When the single-row system is in operation runners should be trained into every alternate alley, leaving every other alley free for cultivation.

MULCHING.

Oat, wheat, or barley straw will be found most satisfactory for mulching. Pine-needles and rushes are sometimes used, but are not recommended when straw is procurable. Hay, also, is sometimes used, but owing to the great number of seeds contained therein it is necessary to expose it to the weather until they have all germinated before it is distributed on the strawberry-beds. Mulches should be applied shortly after the earliest berries have set. The whole ground-surface should be covered, including under the leaves of every plant. A good mulch helps to retain the moisture in the soil and keeps the fruit clean.

HARVESTING.

In the picking and packing of strawberries for market the fruit should never be touched by hand, but rather handled by the stalk. When picking, the stalk should be pinched off between the thumb and forefinger, and not pulled until it breaks as is so often done by careless and inexperienced pickers. This practice of pinching is quick, gives an even length of stalk, and does not injure the crown of the plant. When facing the top layer of berries in a punnet the same practice of handling by the stalk should be adopted; this will be found to materially assist in avoiding bruising of the fruit. Punnet-carriers (or trays) should be sufficiently large to contain four filled punnets. This size is desirable because when the carrier is placed on uneven ground it will not readily fall over. A supply of empty punnets can be carried, telescope fashion, under the punnets that are being filled. As each punnet is filled it should be left in the field to be collected by others, care being taken that the fruit is not unduly exposed to the sun. On bright sunny days the punnets should be collected as soon after they are filled as possible. In small gardens a suitable carrier to use when collecting punnets is one constructed to carry three tiers, with space

for eight punnets on each tier. For large areas a wheel-barrow with a specially constructed body that will carry two tiers of punnets is most satisfactory. A two-wheeled handcart is to be avoided on account of the difficulty of preventing the wheels from damaging the plants.

FUNGUS DISEASES AND INSECT PESTS.

Leaf-spot (*Mycosphaerella fragariae*): A fungus disease known as strawberry leaf-spot is common on many varieties throughout New Zealand. Circular brown-coloured spots, approximately ⅛ in. in diameter, are produced on the foliage. Where the infection is severe the mature leaves may be almost completely covered by these spots, killing the tissue of the part affected and consequently preventing the foliage from functioning as it otherwise would. Periodical sprayings with bordeaux mixture at the following formula during the early summer months will satisfactorily control this disease: Sulphate of copper (bluestone), 4 lb.; quicklime, 4 lb.; water, 40 gallons. The Melba variety is almost immune from attack by leaf-spot, whereas Marguerite is very susceptible.

Grey mould (*Botrytis* sp.): This disease causes considerable decay of partially matured fruit on the plants, and in certain seasons heavy losses of fruit between picking and marketing. It first appears as a brown discoloration, which spreads rapidly over the whole berry, causing decay. The disease thrives best in damp still air conditions, and is found most destructive to fruit on plants growing in poorly drained soils, especially in weedy plantations and during heavy rainfall. Fruit which has been picked damp or held under close atmospheric conditions is most likely to develop decay before marketing. All berries showing signs of grey mould should be discarded at picking-time, so as not to contaminate sound fruit in the same container. Diseased fruits should be destroyed, as they rapidly become covered with the fine grey powdery growth of the causal fungus which is largely responsible for the spread of the disease.

Strawberry-mildew (*Sphaerotheca humuli*): This is sometimes met with in New Zealand. Occasional applications of lime-sulphur at a strength of 1 to 100 will guard against the disease.

Red mite (*Bryobia pratensis*) and red spider (*Tetranychus telarius*): These pests are frequently met with in strawberry-gardens, particularly on plants allowed to remain for the second-season crop. The insects are dull-red in colour, and the former are minutely small, being barely discernable with the naked eye. Being sucking insects, they can do considerable damage to the foliage if not kept in check. Control measures consist of spraying with lime-sulphur at 1–100 plus Black Leaf 40 at 1–800, whenever the pest becomes troublesome. As these insects live principally on the underside of the leaves it is important that the spray should be directed upwards. This can be done by the use of a nozzle that sprays at an angle of 45 degrees from the rod.

Green aphis (*Myzus* sp.): This sucking insect is not uncommon in strawberry plantations throughout the Dominion. It is usually most troublesome on the young leaves as they emerge from the crown, and on the underside of the foliage. A thorough spraying with insecticidal sprays, such as lime-sulphur or Black Leaf 40, will effectively control this pest.

Large brown beetle (*Odontria zealandica*): In certain parts of New Zealand more damage is done to strawberry-plants by this insect than by all other insect pests and fungus diseases combined. The beetle is most active during the dusk of evening, and where sufficient numbers are present they seriously damage the foliage by chewing the young and tender leaves. In addition to the damage that may be done to the foliage, this pest causes far more extensive injury to the plant when in the larval state. The beetles deposit their eggs round the crown of the plant, and on hatching the grubs bore their way into the ground, where they live on the roots, frequently destroying every root that the plant possesses. No satisfactory means of controlling brown beetle, either in the larval or beetle state, has so far been found. Plants that are grown for one season only are not seriously troubled by the larvæ, consequently where the pest is very troublesome replanting every season is the only way of combating it.

SPRAYING.

A barrel of sufficient size to contain 25 gallons of spray mixture, fitted on a wheelbarrow, with a well-constructed light pump attached, will be found suitable for spraying operations in strawberry-gardens. A horse-drawn spray outfit cannot be recommended except in areas of some 10 acres and upwards.

The writer is indebted to Mr. W. H. Rice, Orchard Instructor, Auckland, for information on various points, more particularly with reference to diseases and insect pests; also to Mr. W. K. Dallas, Orchard Instructor, Dunedin, in connection with varieties grown in Otago, &c.

Parasitic Control of Woolly Aphis.—Addressing the recent Fruitgrowers' Conference at Wellington, Mr. D. Miller, of the Cawthron Institute, stated that woolly aphis had been on the increase during the past two seasons; such fluctuations were to be expected. In order that control by the parasite *Aphelinus mali* might be effectively maintained from year to year it would be necessary to keep artificially reared colonies on hand for distribution to localities where there was a temporary increase of the aphis. This would require the services of an assistant giving his whole time to the work.

Wheat Research.—At the July meeting of the Research Council the Chairman stated that the Cereal Laboratory building in Christchurch is being prepared with such standard fittings as will be necessary. The procuring of the technical apparatus and equipment will be left until the Cereal Chemist is appointed. Advice concerning recommendations for this appointment is at present being awaited from the English selection committee. At present an investigation into oven efficiency is under way, the details of the work being carried out by Dr. Barnett. This investigation is for the purpose of providing such information to bakers as will help them to secure reduction of their fuel costs and allow the attainment of a greater efficiency from their ovens.

FROST-PREVENTION FOR ORCHARDS.

(Concluded.)

W. R. Lloyd Williams, F.H.A.S., Orchard Instructor, Alexandra.

IV.—ORCHARD-HEATING.

It is on record that orchard heating has been practised from very early days, Pliny having recommended the heating and smudging which was used as frost protection by the Romans. In the sixteenth and eighteenth centuries these methods were in vogue in the French and German vineyards and orchards, and it was also practised with considerable skill by the Indians of Peru, no doubt inherited from the pre-Spanish civilization. Records of this early work show that some of the methods followed were not as crude as one might suppose; in fact, some of our modern practices are less scientific in their adaptations than the earliest attempts on record. A variety of fuels have been used. In the latter part of last century the French vine-growers and also the citrus-fruit growers of California and Florida were beginning to use heavy oil as fuel. At the same time the deciduous-fruit growers of the north-western regions of North America also were working on similar lines. (*Better Fruit*, March, 1927.)

Although other methods have been suggested, the experience so far in countries that undertake the protection of their orchards from frost is that the only safe and practical means of obtaining complete protection is by actual heating of the air by means of a ***large number of small heaters*** distributed over the area to be protected. In this manner all the air under the "ceiling," previously referred to, is warmed until it is above the danger-point.

Fuel.

The main sources of fuel available are wood, coal, and oil. Wood hardly enters into the picture here, as it is such a scarce commodity in Central Otago. Coal is used in its ordinary condition and also in the form of briquets, but oil is by far the most used in America.

COAL.

Coal has been used in Hawke's Bay with successful results, and a short account of its use is essential. I am indebted to Mr. N. J. Adamson, Orchard Instructor, Hastings, for the following description of the methods employed by Mr. Ralph Paynter in the use of coal in frost-fighting :—

A number of orchardists in Hawke's Bay have attempted to protect themselves against late frosts for quite a considerable time, and they claim that successful "saves" have been made. From observations I have made this (1926–27) season I am satisfied that good results have been obtained by their method of orchard heating. Severe late frosts, sufficient to injure the fruit crop, are not an annual occurrence, and firing has not been resorted to very often, although everything has been in readiness in case of emergency. Mr. Ralph Paynter tells me he has not had to fire since 1918. This year he fired once only.

The method of frost-fighting is by orchard heating, the fuel used being Newcastle coal. Benzine-tins are used for stoves, and are inexpensive and quite efficient. A hole is cut out of one side near the bottom, through which the torch

for lighting may be applied. The fire is set by laying a few dry sticks in a slanting position over the opening, and then the tin is nearly filled with lumps of coal. To keep the fuel dry, the tins are provided with a cover. These may be made out of benzine-tins also, one tin providing three covers if cut correctly.

The method of lighting is by throwing in a piece of the core of a maize-cob previously soaked in kerosene. These may be carried in a bucket, and lit by means of a torch made from a piece of pumice on a wire, the pumice being previously soaked in kerosene. Several of these torches should be on hand. Lighting up may be done very quickly by this method. Two men could light up 3 acres in less than half an hour.

A ton of coal is sufficient for 100 to 120 tins. Tins are placed one to every two trees, and on outside rows one to each tree. This will provide for a seven- to eight-degree frost. Tins, however, may be placed at every tree. This would provide for about ten degrees of frost. Alternate tins could be lit for a start. It may be necessary on occasions to add a little more fuel to keep the heat going for a longer period.

No alarm thermometers are being used. A good thermometer is placed in the orchard a few feet from the ground. A number of growers use a maximum and minimum registering thermometer, usually two, placed in separate positions. The thermometer is watched closely on a night when there is a tendency towards a severe frost. A certain amount of frost injury occurred this season on the lower-lying localities, but the men who fired received no injury.

It has been freely stated that the cost of heating with Newcastle coal is a great deal less than with oil. For a ten-degree (Fahr.) frost which we occasionally have to guard against, at least one hundred tins per acre would be necessary. For an average frost probably eighty might be lit, for which 13¼ cwt. of coal at £4 0s. 4d. per ton (landed at Alexandra) would be necessary, equalling £2 12s. per acre per firing, compared with £1 10s. for oil. Where the coal loses is through the whole of the 13¼ cwt. being consumed at each firing, owing to it being of little value after once being lit, whereas the oil can be extinguished at any time and the rest of it will be quite good. For a long burn probably coal would be a little cheaper, but this advantage can be easily discounted by the extra labour of filling, refilling, and lighting. Coal is also more bulky to handle.

OIL.

Oil is undoubtedly the most popular fuel in America—the home of orchard heating. In California orchard-heating oil, or Diesel oil, varying in density from 24° to 36° Baume, is generally used. That used in our Central Otago experiments, and which proved quite suitable, was the Shell Company of New Zealand's Tarakan oil, a product of British Borneo, from which only the lighter fractions—benzines and kerosenes—have been extracted. Its specific gravity is 0·944, equal to 237 gallons per ton weight. The quotation for this oil is £6 3s. per ton delivered in 42-gallon drums on rail Dunedin; railage to Alexandra, £2 3s. 6d. per ton; freight on empty drums for filling 8¾d. per drum; making a total cost landed at Alexandra of 8·623d. per gallon, or, say, 9d. per gallon in the orchard. The rate of consumption is a little under 1 quart per hour. An average of three firings of two hours each per annum make an average of six hours burning per annum. It has previously been shown that during the last twelve years the greatest number of full firings in any one year would have been six; oil should therefore be on hand at the beginning of the season for at least six heatings.

Equipment.

FIREPOTS.

Many types of heaters, from the elaborate high-stack smokeless to the simple lard-pail, have been evolved, the former mostly for citrus-groves. As we are concerned only with the protection of deciduous fruits, and as the cheaper types of heaters have been found effective here and alsewhere, I will confine my remarks to those suited for this purpose. What is known in America as the lard-pail heater is almost universally used in deciduous orchards. An illustration is shown in Fig. 3 (left). On the right of the same figure is illustrated a 5-quart pot, lid, and spider made by Farra Bros., Dunedin, which has proved suitable for the purpose. The dimensions are—diameter, at bottom 7½ in., at top 9¼ in.; height, 8½ in. The specifications are—bodies, 26-gauge black steel; top, false-wired; bottoms, double-seamed; spiders, 18-gauge black steel with welded arms; lids, 26-gauge black steel with ⅜ in. flanged rim. The price is £9 per 100 sets f.o.r. Dunedin, with a discount of 7½ per cent. off quantities of 1,000 or over. The cost per pot landed in Alexandra would be—in 100 lots 1s. 10⅜d., and in 1,000 lots 1s. 9d. The pots, spiders, and lids should be cleaned, oiled, and carefully stored in a dry shed after danger of frosts is over, leaky pots or bent lids and spiders being put on one side for repairs during the winter months.

DRUMS.

The best method at present of obtaining the oil and storing it is in 42-gallon steel drums, which can be supplied by the Shell Company of New Zealand Limited at 5s. each. So as to enable one man to handle them expeditiously when filled it is advisable to store them on long frames raised from the ground. A large oil-tap will be necessary for running off the oil.

THERMOMETERS.

A sufficient number of accurate minimum thermometers is essential; much oil can be unnecessarily burned or, on the other hand, much fruit lost by not burning enough through being misled by insufficient or inaccurate thermometers. The number required will depend on the nature of the orchard. If the ground is fairly level and the temperatures even on the plot to be heated probably two would be sufficient for 2 acres, three for 4 acres, and five for 10 acres. In addition, at least one is necessary well outside the heated area as a check. Before the time for orchard heating commences growers are advised to take temperatures at various points in order to find out the coldest spots and also to co-ordinate the temperatures of the check thermometers with those in the heated area. The following advice from Dr. Kidson's "Protection of Orchards against Frost" should be carefully read and followed:—

The best type of thermometer to use is the horizontal alcohol minimum thermometer. The existing temperature can be ascertained at any time by reading the end of the column of alcohol, and at the same time the end of the glass index nearest the end of the column shows the lowest temperature reached since the thermometer was last set. It may be necessary to allow the bulb of the thermometer to dip slightly to reduce the friction of the index, which has to be carried back by the surface film of the alcohol. The inclination should not be

more than necessary, however, otherwise a strong wind may shake the index down towards the bulb. The thermometer should be reset each day during the frost period by tilting up the bulb until the index slides down into contact with the surface. It is desirable to take the thermometers in during the hotter part of the day and replace them in the evening. While inside, the thermometers should be kept vertical with the bulb downwards. These precautions are necessary since the spirit is liable to distil into the upper portions of the stem and the thermometer, consequently, to read too low.

Occasionally the spirit column will be broken by bubbles, or the index will break through the surface. The column should then be rejoined by holding the thermometer in the hand with the bulb downwards and tapping the hand on the knee or some soft object. If the thermometer is in a wooden frame, the latter may be tapped gently on a pad until the spirit has all joined up with the main column.

The accuracy of thermometers should be tested when first received and at intervals afterwards. Many are inaccurate. Advice should be taken from a local official as to suitable makes. If there is an expert in the district he may undertake the testing, but if not, it can be done by checking the freezing-point. For this purpose a vessel containing a mixture of chipped ice or snow and water may be used. The mixture should be stirred and the thermometer left in it for several minutes. When read, only sufficient of the stem should be withdrawn to allow of a reading being made, and the reading should be 32° F.

Thermometers should be read quickly, and the light used should not throw out much heat, otherwise the instrument will be warmed and the temperature be forced up during the process. An electric torch is by far the most satisfactory light. The shelter should face south, so as to protect the thermometer from the sun. A thermometer should not be placed near a heater or the temperature recorded will be above the average in the orchard.

If the lines and numbers indicating the degrees become faint they can be freshened up with a little black paint, rubbing off the surplus with soft paper. Rubbing the lead of an ordinary black lead pencil along the stem will also give the desired result.

Two types of thermometers were used in the experiments; one by Negretti and Zambra (British make), costing here £2, and shown in Fig. 11 (bottom right-hand corner); the other a Tycos (American), shown on thermometer-stand in Fig. 6, and costing about 17s. 6d. landed here. Standard minimum thermometers by Pastorelli and Rankin, Ltd., England, are being supplied by the New Zealand Fruitgrowers' Federation, Ltd., to growers at £1 10s. each, with an additional charge of 3s. 6d. for testing.

THERMOMETER SHELTERS.

Standard temperatures are taken at a height of 4 ft. 6 in. to 5 ft. from the ground. Thermometers, if fully exposed to the sky at night, radiate heat and become colder than the air, consequently they register a lower temperature than they should; they are therefore placed under a shelter. A useful shelter is shown in Fig. 6. It consists of a hardwood post, 7 ft. by 2 in. by 2 in. (pointed at one end), to which a board 1 ft. 3 in. long by 9 in. deep is screwed a few inches from the top. On the top of this board is a hinged lid of the same size, bevelled on the edge so that it may hang down like a roof as a protection to the thermometer, which is hung on two screws as high up on the first board as possible. The screw for the bulb end should be very slightly lower than the other, so as to give the thermometer a very slight tilt. The lid can be lifted up, as seen in Fig. 6, for easy reading of the temperature. The post should be sunk in the ground to a sufficient depth to allow for the thermometer being the correct height (4 ft. 6 in.) above

the ground. Most growers have sufficient timber with which to make shelters, but if not they should not cost more than 5s. each.

LIGHTING-TORCHES AND FUEL.

A satisfactory lighting-torch is shown in Fig. 4 (left). The container holds 2 quarts, is 9 in. long by 4½ in. diameter, is made of 26-gauge tinplate, with a handle and a welded spout about half as long again as the container. The spout is fitted at the point with fine-mesh brass gauze, and similar gauze is soldered inside the base of the spout. Under no circumstance should a torch be used with this gauze lacking or defective, for it acts as in a miner's lamp and prevents disastrous explosions in the container. The price f.o.r. Dunedin is 9s. 6d. The fuel used is half kerosene and half benzine, with a slight preponderance of the latter. The torch is tipped up until the fuel runs out from the spout, and is lit with a match. Liquid fire is then dropped into the firepots. When new these are more difficult to light, and in this case a ring of fire should be spread round the edge of the oil. After the first using they are quite easy to light, the soot acting as a wick. In running between pots the torch will remain alight, even if tilted up to prevent dropping the fuel on the ground. An extra supply of lighting-fuel should be prepared and placed in an airtight container; torches should be filled in daylight or in the light of an electric torch.

WHEELED SLEDGE AND CANS.

A low cart or wheeled sledge—which many growers have—is convenient for carting the oil-drums to the orchard for filling the pots. Large watering-cans or a hose may be necessary for transferring the oil from the drums to the pots.

ALARM.

An alarm is essential, especially in a district where there is no local meteorological forecaster of the weather. Without elaborating further on its necessity I would refer readers to Mr. Hinton's experience on 14th November as given on page 397 of the *Journal* for June. A grower has sufficient work in the daytime without having to be continually on watch at night, for there is nothing more wearying after a day's work than night watching. The alarm used in the experiments (Fig. 6), a Tycos, was quite satisfactory, and is the only one with which I am acquainted. It is designed to give an alarm by ringing an electric bell when the temperature surrounding the thermometer has fallen to a certain point. These instruments may be obtained to ring at any temperature, but from our experiments last spring I would suggest, for safety, one ringing at 32° F. The thermometer, which is already protected, is placed on a post in the coldest location (previously ascertained); insulated wires connect it with the box containing the batteries, bell, and relay placed in the bedroom. The copper wires should be not less than No. 18 B. & S. for a distance up to 1,400 ft., and for a greater distance No. 14 B. & S. The wires should be fixed on poles overhead and not allowed to trail on the ground, and for convenience the insulation of each should be a different colour.

The thermometer consists of a positive-acting mercury-filled glass tube with a fine platinum wire permanently fused into the bore of the tube at the temperature-point at which it is desired the alarm should ring. A second wire, touching the mercury at a spot below the other, completes a circuit which is broken the instant the mercury falls below the alarm-point, and causes the alarm to ring in the house. It should be carefully tested to see that it rings at the temperature at which it is registered, and the batteries should be replaced annually. The height at which the alarm thermometer should be placed on the post can only be determined by actual experiment. If not convenient to place it in the coldest part of the orchard, temperatures must be taken there and at the point at which the alarm thermometer is to be placed. For example, if when the temperature in the coldest part of the orchard at 4 ft. 6 in. above the ground is 32° F. that at the alarm thermometer at the same height is only 34°, the alarm would not ring until the temperature in the orchard was 30° F., which might be disastrous. The earlier remarks on temperature inversion indicated that the temperature rises from the ground up; therefore, in the present instance the alarm thermometer should be lowered until the temperature there and in the orchard coincides. The cost of these alarms is £8 10s. complete with batteries, wiring, and relay.

A simple and cheap alarm sent to me by Mr. R. G. Hamilton, Orchard Instructor, Auckland, is being used successfully by a tomato-grower in that district, and will receive testing and further investigation next spring. It consists of a flat horizontal arm composed of brass, on the top of which is vulcanite. Owing to the different actions of brass and vulcanite to cold, the increasing cold causes the arm to lift until it reaches a platinum-tipped brass screw, the circuit is closed, and a bell connected by wires and three dry cells rings in the bedroom. Alteration of the adjustable screw allows of the contact being made at whatever temperature it is desired the alarm should ring. Full working drawings and specifications are in my hands. The cost of the instrument with bell and 100 yards of bell wire, but excluding batteries, is about £2.

Heating Operations.

WHEN TO PUT POTS IN THE ORCHARD.

This must be determined by the season—that is, according to the time the apricot blossoming commences. From notes taken from Mr. Bringans's diary for the years 1919 to 1927 it would appear as if the earliest at which the apricot commences to throw out its first few blossoms in this locality is during the last few days of August, and blooming usually lasts about a fortnight. Sometimes it is considerably later. Probably the last week in August or the first week in September would be the average time for the district, according to the season, although it is not anticipated, except under very exceptional circumstances, that the pots would need to be lit before the middle of September. Each grower would be wise to keep an annual record of the flowering-periods of the different fruits.

NUMBER OF POTS PER ACRE AND DISTRIBUTION.

It is impossible to advise, after only one season's experience with only a single acre, as to how many pots are required per acre or even

their exact location. However, I would not like to endeavour to protect 1 acre without having 120 pots distributed over the area, although probably not more than 100 would ever be lit at one time, and often less. Allowing the same distances apart between the pots, this would be approximately equivalent to 100 pots per acre for 2 acres, 86 pots per acre for 5 acres, and 78 pots per acre for 10 acres, providing the blocks were approximately square. The shape of the area to be protected—whether long and narrow or square—will cause some variation in the numbers and distribution. With the increase in the size of the protected area it is quite reasonable to assume that owing to the accumulated heat of such a larger area, if compact, the pots per acre might be decreased. The arrangement of the pots should be something on the lines discussed in the earlier part of this article dealing with the experiments, and shown in Fig. 10. Where the trees are planted 18 ft. apart on the square, I would suggest as a basis that the pots in the outside row on the east should be 9 ft. apart, and on the south and north 18 ft. On the north, east, and south sides place a row 18 ft. inside the outer one and 18 ft. between the pots in the rows. In the remainder of the area allow 27 ft. apart between the rows of pots and between the pots in the rows. As shown in Fig. 10, the pots should be zigzagged so as to spread out the heat as much as possible. The 27 ft. distances will occasionally bring the pots where the trees stand, but the heaters can be shifted slightly one way or the other to come between the trees in the rows. For the purpose of driving down the rows with the oil for filling and refilling it is wise to keep the rows one way well defined (the zigzagging being only one way) and the distances between pots as multiples of the distances between the trees. Where there is any difficulty in working out the number of pots required or their distribution I would be pleased to afford orchardists any assistance required. It should be pointed out that more pots are placed on the eastern side for two purposes: in the event of a very bad frost coming from any of the other directions every alternate pot from the east can, if necessary, be transferred to the danger-zone, and again they are an advantage if required to act as a smoke-screen against the rising sun.

FILLING POTS.

As soon as the pots are put out in the orchard they should be filled to within an inch of the top with oil. A convenient method would be to cart one or two drums at a time on the wheeled sledge. To the tap in the drum might be affixed a rubber hose a few feet long to run the oil direct into the pot, or it may be run into large watering-cans and put into the pots with them. Two men will be much handier than one—one at the tap and the other with the hose or cans. The spiders and lids should be put on immediately after filling. In the event of a firing the pots should be refilled before the following night in case of another frost.

WHEN AND HOW TO LIGHT.

When once the pots are put out in the orchard the alarm should be switched on every night until they are again stored in the shed.

As soon as the alarm rings cut if off, and get to the thermometers at once and watch their movements. If there is a steady fall to the danger-point, light up immediately. If, on the other hand, the temperature is wavering it is better to wait awhile until there is a clear indication of the direction in which the temperature is working. It was found last season that the colder the night the nearer to sunrise was the lowest temperature recorded; if a heavy frost occurred the coldest point would be between dawn and sunrise. In the event of the temperature rising and it being decided to return to bed, be sure the alarm is switched on again in case of a drop in the temperature towards dawn, for undoubtedly the most dangerous time is from just before dawn until sunrise.

When commencing to fire up, light for a start each alternate pot throughout the area, commencing on the side from which the air-drift is coming, probably the east and south sides. After deciding to light no time should be wasted; with an assistant taking off the lids one should be able to light an acre in five or six minutes. Keep a watch on the thermometers, and if the pots already lit do not hold the temperature, light a few more here and there where it is thought advisable. On the other hand, if the temperature is rising above the safety-zone extinguish some by replacing the lids; apart from wasting oil it is not wise to overheat. Just endeavour to keep on the safe side, using the Californian chart of dangerous temperatures (July *Journal*, page 25) as a guide. Keep a continuous watch on the pots in case the spiders need clearing of soot, and see that those lighted do not go out, as an odd one may do. As soon as the temperature outside the heated area has risen above the danger-point it will be safe to extinguish the fires by simply replacing the lids, commencing on the west side and working towards the east. If the frost has been a severe one it may be wise at sunrise to light additional fires on the eastern side with the spiders off in order to create a smoke smudge against the rising sun, as shown in Fig. 9.

WHEN TO RE-STORE EQUIPMENT.

It is difficult to advise on this point, for, as was shown earlier (June *Journal*, page 401) an unexpected frost occurred on 8th December last, contrary to usual experience. Judging from past records, early December appears to be usually a safe time for putting away all gear for the season.

Costs of Orchard-heating for Central Otago.

These estimates of costs must of necessity be crude and be considered as approximate only, and much will depend on the man and the orchard. Depreciation on equipment is shown at 10 per cent., and therefore the 3 per cent. interest charged on initial cost is equivalent to 6 per cent. on the average capital invested. Table 11 gives an estimate of the initial costs of heating equipment, fuel, &c., for 1-, 2-, 5-, and 10-acre orchards; sufficient fuel is allowed for the estimated maximum of six full burnings of two hours each for the year. Table 12 shows the overhead charges which must be allowed for annually, whether the pots are used or not. Table 13 presents the annual running-costs based on the average of six hours burning per annum. Table 14 shows the total annual average costs.

Table 11.—Estimated Initial Cost of Heating Equipment for 1, 2, 5, and 10 Acres of Deciduous Fruits.

Items.		1 Acre.		2 Acres.		5 Acres.		10 Acres.	
		Quantity or Number required.	Cost.	Quantity or Number required.	Cost.	Quantity or Number required.	Cost.	Quantity or Number required.	Cost.
			£ s. d.		£ s. d.		£ s. d.		£ s. d.
Heaters, at 1s. 9d.	No.	120	10 10 0	200	17 10 0	430	37 12 6	780	68 5 0
Oil (six heatings, 3 gallons per pot, at 9d. per gallon)	Gall.	360	13 10 0	600	22 10 0	1,290	48 7 6	2,340	87 15 0
42-gallon drums, at 5s.	No.	9	2 5 0	15	3 15 0	31	7 15 0	56	14 0 0
Wheeled sledge, cans, and fittings ..	..	..	5 0 0	..	5 0 0	..	5 0 0	..	10 0 0
Thermometers, at £1 13s. 6d. ..	No.	3	5 0 6	3	5 0 6	4	6 14 0	6	10 1 0
Thermometer-shelters, at 5s. ..	No.	3	0 15 0	3	0 15 0	4	1 0 0	6	1 10 0
Torches, at 10s.	No.	1	0 10 0	1	0 10 0	2	1 0 0	3	1 10 0
Lighting-fluid, at 2s. 6d.	Gall.	1	0 2 6	2	0 5 0	4	0 10 0	8	1 0 0
Alarm, complete	No.	1	8 10 0	1	8 10 0	1	8 10 0	1	8 10 0
Initial cost	..	..	46 3 0	..	63 15 6	..	116 9 0	..	202 11 0
Initial cost per acre	..	..	46 3 0	..	31 17 9	..	23 5 10	..	20 5 1

Table 12.—Estimated Annual Overhead Costs.

Items.	1 Acre: Cost.	2 Acres: Cost.	5 Acres: Cost.	10 Acres: Cost.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Depreciation: 10 per cent. on initial cost of heaters, drums, sledge, &c., thermometers, thermometer-shelters, torches, alarm, and lighting-fluid	3 5 4	4 2 7	6 16 2	11 9 7
Interest, 3 per cent. on above	0 19 7	1 4 9	2 0 10	3 8 10
Interest on oil at 6 per cent.	0 16 3	1 7 0	2 18 1	5 5 4
Labour: First putting out of pots, filling, re-storing, and repairs	1 0 0	1 15 0	3 15 0	7 0 0
Annual overhead cost	6 1 2	8 9 4	15 10 1	27 3 9
Annual overhead cost per acre	6 1 2	4 4 8	3 2 0	2 14 5

Table 13.—Estimated Annual Average Running Costs.

Items.		1 Acre.		2 Acres.		5 Acres.		10 Acres.	
		Quantity or Number required.	Cost.	Quantity or Number required.	Cost.	Quantity or Number required.	Cost.	Quantity or Number required.	Cost.
			£ s. d.		£ s. d.		£ s. d.		£ s. d.
Oil for six hours, $1\frac{1}{2}$ gallons per pot, at 9d. per gallon	Gall.	180	6 15 0	300	11 5 0	645	24 3 9	1,170	43 17 6
Lighting-fluid, at 2s. 6d. per gallon ..	Gall.	$\frac{3}{4}$	0 2 0	$1\frac{1}{2}$	0 3 9	3	0 7 6	6	0 15 0
Batteries for alarm, at 2s. 6d. each ..	No.	3	0 7 6	3	0 7 6	3	0 7 6	3	0 7 6
Labour, lighting, refilling, &c. ..	..	..	1 15 0	..	3 10 0	..	7 10 0	..	14 0 0
Annual running cost	..	..	8 19 6	..	15 6 3	..	32 8 9	..	59 0 0
Annual running-cost per acre ..	..	..	8 19 6	..	7 13 2	..	6 9 9	..	5 18 0

Table 14.—Estimated Total Average Annual Costs.

Items.	1 Acre: Cost.	2 Acres: Cost.	5 Acres: Cost.	10 Acres: Cost.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Annual overhead costs ..	6 1 2	8 9 4	15 10 1	27 3 9
Annual running-costs ..	8 19 6	15 6 3	32 8 9	59 0 0
Total costs ..	15 0 8	23 15 7	47 18 10	86 3 9
Total cost per acre ..	15 0 8	11 17 9	9 11 9	8 12 5

V.—PROTECTION OF TOMATO CROPS FROM FROST.

Although the foregoing experiments and the advice given in this article were primarily intended for the assistance of the fruitgrower, much of it is applicable to the protection of tomato and other crops which bulk largely in the economy of this district.

Cutting back Frosted Tomato-plants.—Acting under my advice, Mr. W. H. Hinton, Earnscleugh, after a heavy frosting of his tomato-plants last spring immediately cut them off close to the ground. The contrast between these plants and some less frosted and left uncut was most remarkable; the former made a great recovery and carried an enormous crop, while the untreated ones never properly caught up and only carried a light crop.

Autumn Experiments.—The alarm and several of the thermometers previously referred to were set up in the orchard of Hinton's Orchards Ltd., at Earnscleugh, at a late period last season, to experiment in the protection of the tomato crop against autumn frosts. Mr. W. H. Hinton's report is interesting and may be quoted as follows:—

The tomato patch protected was divided into bays by rows of fruit-trees, the whole area being a little under 1 acre and containing 9,000 plants. Thermometers numbered 1, 2, 3, and 4 were placed one at each corner. No. 1 was on the highest ground and under the willows; this thermometer on a cold night registered four to five degrees higher than No. 3. The alarm thermometer (Fig. 6) was situated between Nos. 3 and 4. All four thermometers and the alarm thermometer were 1 ft. from the ground. On the morning of 5th April, 1928, the alarm rang at 3.45 a.m. We waited for three or four degrees of frost before lighting up, but instead of dropping the temperature rose four degrees and then dropped; the alarm rang again at 5.30 a.m., and the temperature gradually dropped until sun-up. At 6.10 a.m. the readings were—No. 1, 34°; No. 2, 31°; No. 3, 30°; and No. 4, 31·5° F. With half an hour to go before sunrise, and the temperature still dropping, we decided to light all pots which showed a coating of hoarfrost on the lids—thirty in number—in the vicinity of No. 3 thermometer. Although we did not raise the temperature of the latter, which could hardly be expected with only thirty pots, we certainly held it, as shown by the following readings at 6.45 a.m., when the pots were extinguished: No. 1 had dropped one and a half degrees since 6.10 a.m.; No. 2 two degrees; No. 3 was the same (30° F.); and No. 4 had dropped two degrees. This being our first experiment with autumn frost-fighting, we could only guess how much frost old hardened plants could stand. In the lighted area the leaves of the plants were soft when the fires were put out, but in other parts, where the temperature dropped below freezing-point, a fair proportion of the top leaves were stiff. Soon after this the prospects were for very heavy frosts, and we decided to pick the balance of the crop and the pots were put away.

VI.—ADDITIONAL EXPERIMENTS.

An attempt was made last autumn to co-ordinate the standard temperatures in the Stevenson screen with those registered by our field thermometers under the hooded shelters, and also with the ground temperatures. The arrangement of the apparatus is shown in Fig. 15.

The temperature under our field shelters appears to be anywhere from half a degree to five degrees lower than in the Stevenson screen, and the grass temperature apparently runs from one and a half to six degrees below that under the field shelter. However, the variations in the lower registers—32° F. and lower—appear to be more consistent, the difference being from three to five degrees and mostly about four degrees. It is trusted that more data will become available in this connection when the climatological station is established here.

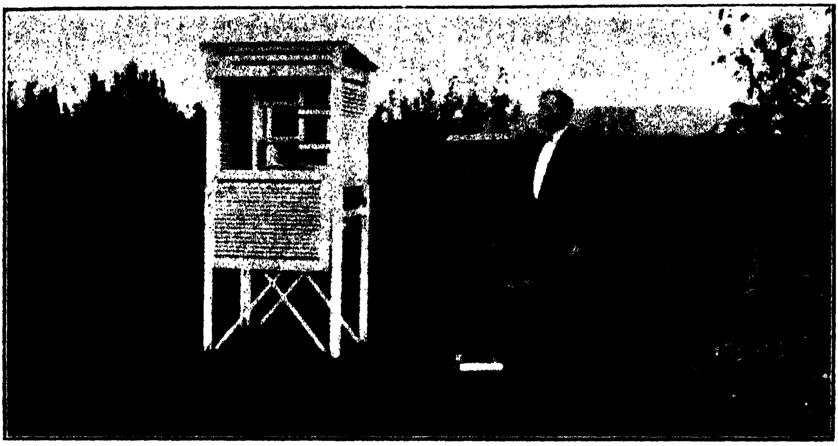

FIG. 15. STANDARD STEVENSON SCREEN (AUSTRALIAN PATTERN), FIELD HOODED SHELTER WITH THERMOMETER, AND UNCOVERED THERMOMETER.

On left, the Stevenson screen with door opened downwards. On right, field hooded shelter with minimum thermometer. At foot of shelter another minimum thermometer, uncovered and supported 2 in. from the ground. The screen is open directly to the south; the Old Woman Rock (N.N.W.) can be seen on the highest point immediately on left of screen, while the writer is looking directly at the Old Man Rock (S.W.).

[*Photo by F. Varney.*

The Government has decided to make another grant for the continuance of the experiments during the coming season, for although we certainly have behind us the experience of years of orchard heating in America we are still in the early stage so far as local information is concerned. It has been decided to arrange the next experiments on a larger scale by combining forces with Mr. Bringans. With the pots owned by him and the Department of Agriculture, and the combined use of the oil, it is hoped in the event of frost to protect an area of 4 or 5 acres.

"PULPY-KIDNEY" DISEASE OF LAMBS: A NEW THEORY.

At the annual conference of the New Zealand Veterinary Association held in Wellington last month Mr. D. A. Gill, M.R.C.V.S., of the Wallaceville Laboratory, advanced a new theory regarding the "pulpy-kidney" disease which causes considerable mortality among young fat lambs. Briefly, he stated that while still regarding the primary cause as nutritional—the overfat lambs being exposed to the attacks of intestinal bacteria—he had formed the opinion that certain bacteria, normally present in the large intestine, might be responsible for setting up the toxic condition which caused death. He had found these bacteria in the small intestine of affected lambs, and when located there they would be in a good position to exert adverse chemical changes on the passing food, and the products resulting from those changes would be far more easily absorbed than from the large intestine. Assuming that such products were of a particular kind and this was very likely the case—then all the post-mortem lesions usually found in this disease, and all such anti-mortem symptoms as were sometimes observed, could be readily accounted for. Mr. Gill's theory was well received by the conference, and, while some friendly criticism was offered, the view was expressed that it was well worth continued investigation.

ORCHARD IRRIGATION BY MOBILE PIPE SYSTEM.

PROMISING EXPERIENCE IN MARLBOROUGH.

M. DAVEY, Orchard Instructor, Blenheim.

DURING the greater part of the main season of 1927–28 the rainfall in Marlborough—so far, at least, as the Marlborough Plain was concerned—was very deficient. The rain-gauge at Spring Creek registered as follows: October, 0·68 in.; November, 3·57 in.; December, 0·73 in.; January, 0·02 in.; February, 1·73 in.; March, 1·92 in.—making a total of 8·65 in. for the six months. This meant that fruit-development with regard to colour, size, and in some varieties maturity, was much retarded, especially when one considers that December, January, and February are the three principal months affecting fruit in these respects. In addition, hot drying winds from the north-west were persistent, causing abnormal transpiration of the foliage. A stratum of coarse shingle underlying many of these orchards, at varying depths, disconnects capillarity after the water has receded below permanent winter levels, leaving the cultivator entirely dependent on the conservation of moisture contained in the soil above the shingle. The conditions, in fact, were such as to place fruitgrowers in certain orchards in a precarious position.

Under the limited rainfall and drying conditions mentioned, ways and means to avoid a complete failure of the fruit crop and serious debilitation of the trees had to be actively considered, with the result that Messrs. Ivory Bros. imported from South Australia a small surface-irrigating plant of a method known as Pope's irrigation system.

Briefly, the system consists of a water-main which can be easily transferred and laid down between the trees on the surface of the ground, and which delivers a supply of water over such ground by distribution from single sprinklers placed 18 ft. apart on the top of the pipes. The maker's claims for this system are as follows: (1) It ensures perfectly even distribution of water for the full length of the line; (2) no grading of the soil is necessary; (3) hillside may be irrigated as easily as the flat; (4) a great comparative saving of water is effected; (5) night watering can be carried out; (6) a great saving of labour is effected, little or no attention being required between the times of shifting over from one area to another; (7) working at 30 lb. pressure, 300 gallons per hour passes through each sprinkler, equivalent to 4 in. of rain in two hours.

These claims seem to be borne out in practice so far as local experience during the past season has shown, but quantities of water delivered have not been checked. The plant was installed during the latter end of February, and applied to a block of Cox's Orange apple-trees when a pronounced dropping of the foliage on this and other varieties had set in. Development of the fruit was also at a standstill, and the outlook was decidedly serious. Surface cultivation had been consistently undertaken prior to this time, but the resources in this direction were evidently exhausted.

The writer had an opportunity of inspecting this block of Cox's Orange nine days after irrigation had been commenced, the moisture so obtained having been conserved by cultivation as soon as the wet ground would permit. The beneficial results then showing were most pronounced, the foliage having assumed a flourishing appearance, while the fruit had evidently quite picked up in development, as evidenced by an improved colour and tightness of the skin. In this instance the pipe-line was shifted after every two hours' delivery of water, this being necessary owing to the large area suffering from drought conditions and the belated application of moisture. With more time available it would undoubtedly be prudent to start irrigation on these lines in January, and so avoid extremes with consequent detriment to the trees and fruit.

In another case, owing to lack of opportunity, only 50 per cent. of a block of Jonathan apples received treatment. On examination during the month of June the development of fruit-buds for next season was undoubtedly superior on the irrigated block compared with that of the non-irrigated trees.

The matter may be summarized as follows:—

(1) For the class of land under consideration—light sandy to good river silts—the system described has great advantages, the trees deriving maximum benefit from a minimum amount of water, while serious leakage through extremely open subsoils can be avoided by moderate and frequent applications.

(2) The water is delivered under almost natural conditions, being aerated and the temperature raised in passing through the atmosphere from the sprinklers, circumstances which should tend to produce fruit superior to that raised under the flooding irrigation system.

(3) The installation costs should be very moderate, as in this instance 500 ft. of 2 in. reticulation piping was kept at the necessary pressure to distribute water from the sprinklers over a diameter of 20 ft., with the power supplied by a second-hand 2-horse-power slow-duty engine. The water was obtained by driving a pipe to a depth of 30 ft. The pipes are 18 ft. sections of thin sheet galvanized steel with wrapped edges, connected by a section of rubber hose with small clamp operated with eccentric clips, ensuring very rapid attachment and disconnection. The short lengths of connecting hose also enable the operator to embody curves and slight angles in the pipe-line. Screwing down of all sprinklers converts the pipe into a conduit for conveying water for any other purpose.

From his limited experience of this system the writer would recommend intending users to employ two lines of moderate length, for the following reasons: For some time after the water is shut off the surface of the ground irrigated is thoroughly waterlogged; in consequence it is difficult to get about on, and such contact is best avoided until the free moisture has had time to percolate to a lower level. With two lines of piping no time need be lost in transferring pipes from one area to another, as one line can be in service while the other is being shifted.

GORE EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1927-28.

R. McGILLIVRAY, Fields Superintendent, and J. E. DAVIES, Assistant Instructor in Agriculture, Invercargill.

WEATHER conditions during the past season were not favourable for the growth of the various crops under trial at the Gore Experimental Area. Heavy rainfall was experienced in the early spring. October gave advent to fair conditions for cultivation, and during this month and early November the majority of the crops were sown. Crops generally germinated well and made a good start, but the cold period experienced during November and the first week of December, followed by a period of very dry weather from the New Year onwards, checked growth, and this was reflected in the final yields, and more particularly so in the case of swedes and potatoes. The rainfall at Gore for the year ended 30th June, 1928, was 32·84 in.

Farmers continued to take considerable interest in the various experiments throughout the season. The Gore Branch of the Farmers' Union held a field day at the Area during February. The attendance was large, and all branches of the work appeared to be of interest to those present. The agricultural class of the Wyndham District High School also visited the Area and had the scheme of experiments explained.

The area under cultivation was chiefly devoted to a continuation of the investigations in connection with plant-diseases, but manurial and variety trials were also undertaken.

CONTROL OF OAT-SMUT.

A continuation of last year's work was undertaken. The treatments were (1) formalin, (2) bluestone, (3) hot water; and the necessary controls were provided for. Periodical examinations of the various plots were made throughout the season. Smut was prevalent in the controls, and traces were found in the formalin and bluestone treatments, but the hot-water-treated plots were quite free from the disease.

GREEN FORAGE CROPS.

Chou Moellier.—This crop germinated well, with every sign of a heavy yield, but early in December it was attacked rather severely by grass-grub. This, together with adverse weather conditions, resulted in a somewhat uneven patchy crop. The outstanding feature was its resistance to club-root on land where other cruciferous crops were badly attacked. The manurial test comprised four comparisons, ten replications of each being made, with a standard of 2 cwt. superphosphate per acre. Results were as follows :—

	Tons per Acre.
A. Standard (superphosphate)	12·8
B. Standard, plus 1 cwt. blood	15·0
C. Standard, plus 1 cwt. 30-per-cent. potash salts ..	15·7
D. Standard, plus 1 cwt. blood and 1 cwt. 30-per-cent. potash salts	15·0

Throughout the period of growth the B, C, and D mixtures stood out prominently, the crop in these plots appearing more even, and plants showing more robust growth of stem and leaves.

Thousand-headed Kale.—This crop was grown in 26 in. drills, and up to the time of thinning in December made poor growth ; but during January growth was rapid, and a fair crop resulted. A striking feature in this block was a portion of the land which had not been limed. The line of demarcation was most distinct. On the unlimed portion the growth consisted of sorrel and weeds, with a few odd stunted plants of kale. On the limed area adjoining a good average crop was obtained without weeds being prominent. Phosphatic manurial trials were conducted, the plots being replicated seventeen times. Manures were applied at the rate of 2 cwt. per acre in each case. Results were as follows :—

	Tons.		Tons.
Superphosphate ..	15·7	Ephos phosphate ..	15·6
Seychelles guano ..	14·6	Nauru phosphate ..	14·3

No appreciable difference could be distinguished between treatments during growth, excepting that the Nauru plots were slightly slower in growth than the others.

POTATOES.

The pure line of the Up-to-Date variety that has been selected at this Area has been kept under close observation for another season, and weak and uncharacteristic plants were removed from the growing crop. This line can be said to be 100 per cent. pure, and the demand for seed is keen, but only a moderate quantity is on hand. Similar work on Arran Chief was got under way this season. It is hoped that in about a year's time a stock of pure line Arran Chief will be secured for distribution.

Control of Corticium Disease.- The work of testing clean potatoes against those affected with corticium disease was undertaken on an area of land ploughed out of grass. Clean seed was planted in plots consisting of four rows alternately with similar plots (controls) of seed affected with the disease. The clean seed plots made much quicker growth and stood out conspicuously over the adjoining controls, and reached their highest peak of growth early in January, when they suffered severely on account of dry weather. The controls, on the other hand, were fully a month later in growth, and were fortunate that at the height of their growth a warm rain fell. The results were outstanding and encouraging in the case of the clean seed, and the treatment points the way to the control of this disease. During April the plots were lifted and the tubers were carefully examined by a representative of the Field Mycologist. Thirty comparisons of weights were taken, the potatoes being graded in the field into three classes and weighed separately. Results on a per-acre basis were as follows : Yield from clean seed, 7·44 tons ; yield from controls, 5·69 tons ; difference in favour of clean seed, 1·75 tons. The clean seed was the progeny of seed treated with mercuric chloride and hydrochloric acid in the preceding season, and the seed this season was not treated. It showed 2 per cent. of corticium infection at time of planting. The

resultant crop showed 13 per cent. of infection, as against 100 per cent. infection in the controls.

Through the enterprise of the overseer thirty-eight varieties of potatoes were grown in small plots, and proved of great interest to many visitors to the Area. Some promising varieties were noted and will be tested again this coming season.

ROOT CROPS.

The yields of root crops were below the average, owing to climatic conditions. All cruciferous seeds sown on the Area, with the exception of two varieties of swedes, were treated with hot Semesan by Mr. J. C. Neill, Field Mycologist, as a prevention against dry-rot. These crops were kept under close observation from the early stages of growth until the end of June. Slight dry-rot infection was found in places in May, as compared with November infection in other seasons.

Swedes.

The manurial trial of swedes, in which various phosphatic fertilizers were used, created a great deal of interest. All the fertilizers were applied at the rate of 2 cwt. per acre. The series consisted of six different fertilizers, two drills of each, and replicated ten times. The plots all germinated satisfactorily except the superphosphate ones, which were uneven in growth and the plants yellow. These characteristics were in evidence for some time; as the season advanced the plants made rapid growth, but the crop was not as even as with the other treatments. During December a plant count was made. A 10 ft. rod was laid in the row, and the plants falling within were counted. This was done with each row, continuing in a line right across the block, forty counts being taken in each treatment. The average of the counts is as follows, representing number of plants falling within lengths of 10 ft.:—

Superphosphate ..	37·9	Walpole phosphate ..	55·3
Ephos phosphate ..	51·7	Nauru phosphate ..	55·8
Seychelles guano ..	55·1	Sulfurophosphate ..	53·7

The crop was weighed on 11th June, with the following results:—

	Tons per Acre.		Tons per Acre.
Superphosphate ..	19·4	Walpole	20·3
Ephos	21·4	Nauru	18·4
Seychelles	21·8	Sulfurophosphate ..	18·8

An area of Caledonian swedes was devoted to a trial of potash and super against a control of super alone. This was a very fine crop throughout, but was rather badly attacked with club-root. Results were as follows:—

	Tons per Acre.
Super, 2 cwt. per acre	39·0
Super 2 cwt., 30-per-cent. potash 1 cwt.	38·6
Super 2 cwt., muriate of potash ½ cwt.	38·3
Super 2 cwt., sulphate of potash ½ cwt.	40·0

A variety trial of swedes fertilized with super and Seychelles guano resulted as follows: Conqueror Green-top, 22·7 tons per acre; Smith's Victory, 28·4 tons; Vilmorin's Purple-top White, 33·4 tons. Vilmorin's

was a very even block, with sound roots deeply imbedded in the soil and hard to lift.

Turnips.

A block was devoted to the growing of Green-top Aberdeen turnips, and manurial trials were conducted with these. Each plot consisted of two rows, replicated twenty-eight times. The strike was uneven and yield low, but the roots were of good quality and average size. Club-root was in evidence, and in patches had reached an advanced stage. The crop was weighed on 5th June, with following results :—

	Tons per Acre.
Standard (1 cwt. super and 1 cwt. Nauru)	17·5
Standard, plus 1 cwt. 30-per-cent potash salts	18·9
Standard, plus 1 cwt. 30-per-cent. potash salts and 1 cwt. blood	20·1

The series containing potash was distinct throughout, and the complete manure gave a better start, but in the later stages of growth the various treatments could not be differentiated.

Mangolds.

Six varieties were sown and proved of interest to visitors, as very few crops of mangolds are to be seen in the district. Results, backed by those of previous seasons, show that a profitable crop can be grown. Variety yields were as follows :—

	Tons per Acre.
Barras Stryno V strain	29·5
Barras Taaroje Trifolium VI strain	26·2
Wiboltt's Dana Ovoid Giant Imp. strain	21·6
Sludstrup Yellow Long Ovoid	21·5
Half Sugar Giant Rose Marienlyst V strain	14·0
Taaroje Yellow Short Ovoid	13·8

A block of approximately 1 acre under manurial trial, with the Prizewinner variety, proved a fair crop. The standard manure was super, 2 cwt. per acre ; seeding, 4 lb. per acre ; number of replications, eight.

	Tons per Acre.
Standard	19·3
Standard, plus 1 cwt. blood	18·6
Standard, plus 1 cwt. blood and 1 cwt. 30-per-cent. potash salts	20·6

The crop was very even throughout, and consisted of sound-quality roots.

Carrots.

Half an acre of carrots was grown, and did well. The size and quality of the roots was excellent, but the crop was a thin one. Manuring consisted of 1½ cwt. super and ½ cwt. 30-per-cent. potash salts per acre. The average yield per acre was 24·6 tons.

SUGAR-BEET.

A small area of sugar-beet was grown at the request of the Gore branch of the Farmers' Union. The seed was sown in October ; manurial treatment was 2 cwt. super, 1 cwt. potash salts, and 1 cwt. blood per acre. Germination was satisfactory, and the plants made

splendid growth. The roots were lifted on 27th June, weights per acre being as follows: Australian, 26·3 tons; Bergamens, 29·3 tons; Kenwanzleben, 32·7 tons. The roots were large and rough. Bergamens appeared to be the best quality. Representative roots from each variety have been sent to the Department's Chemical Laboratory for testing for sugar content.

SPECIAL HAY CROPS.

An area of 5 acres was given to hay crops, subdivided into three equal blocks, all seeded at the rate of 3 bushels per acre, and manured with basic super at the rate of 2 cwt. per acre. The seed mixture in each block consisted of 1½ bushels of Crown oats, to which was added equal quantities of the following: Block 1, Partridge peas; Block 2, Scotch winter vetches; Block 3, Lathyrus peas. The crops were cut and weighed on 15th February, giving the following average yields per acre: Block 1, 6·5 tons; Block 2, 11·3 tons; Block 3, 5·5 tons.

The overseer, Mr. J. Sleeman, carried out the duties of his position in a most satisfactory manner, and Mr. H. Martin, contractor for cultural operations, made excellent work of the drilling, &c.

BORDEAUX AND LIME-SULPHUR SPRAYS.

COMPARATIVE TEST IN CANTERBURY ORCHARD.

L. PAYNTER, Orchard Instructor, Christchurch.

THE relative merits of bordeaux and lime-sulphur sprays on different varieties and kinds of orchard-trees in different localities is always a subject of interest and careful study among fruitgrowers. With a view to obtaining definite information on the point as regards his own orchard Mr. F. W. Cone, of Papanui, Christchurch, arranged and carried out during last season a specially designed spraying programme in co-operation with the Horticulture Division, the actual aim being the control of black-spot, red mite, &c. The trees given this treatment were Sturmer and Delicious apples only. The locality generally is rather dry, the average rainfall being under 30 in. per annum.

Particulars of the spraying schedule for the trials are presented in the following table:—

Date.	Stage.	Spraying Materials.	Variety.
26/8/27	Dormant ..	Red oil 1–10	Delicious.
26/8/27	Dormant ..	Bordeaux 8–6–40, red oil 1–100 ..	Sturmer.
26/9/27	Between tight and open clusters	Bordeaux 6–5–50, red oil 1–100 ..	Delicious and Sturmer.
10/10/27	Pink	Bordeaux 3–4–50, red oil 1–100 ..	Delicious and Sturmer.
29/10/27	Petal-fall ..	Bordeaux 1½–3–50, red oil 1–100 ..	Delicious and Six Sturmers.
29/10/27	Petal-fall ..	Lime-sulphur 1–100	Six Sturmers*

SPRAYING SCHEDULE—*continued.*

Date.	Stage.	Spraying Materials.	Variety.
14/11/27	Fruit-set ..	Arsenate of lead powder 1½ lb. to 100 gal.	Delicious and Sturmer.
29/11/27	Fruit good size ..	Bordeaux 1½–3–50, arsenate of lead 1½ lb. to 100 gal., red oil, 1–100	Delicious and Sturmer.
19/12/27	..	Sulpho 8–100, arsenate of lead powder 1½ lb. to 100 gal.	Delicious and Sturmer.
3/1/28	..	Sulpho 8 lb. to 100 gal., arsenate of lead powder 1½ lb. to 100 gal.	Delicious and Sturmer.
1/2/28	..	Sulpho 8 lb. to 100 gal., arsenate of lead powder 1½ lb. to 100 gal.	Delicious and Sturmer.

The remaining trees in the orchard, including Sturmers and Delicious, were sprayed with lime-sulphur, 1–10, at green-tip, 1–40 between open cluster and pink, 1–120 at petal-fall, 1–200 plus Sulpho and arsenate of lead three weeks later, the spray being thereafter repeated at the usual intervals.

Observations were recorded during the period of the test as follows, and should be read in conjunction with the tabulated spraying programme :—

12/11/27 : Foliage superior on all trees sprayed with bordeaux plus 1 per cent. oil, except Six Sturmers marked *. These trees received lime-sulphur at petal-fall, following bordeaux ; fully one-third of the foliage had fallen. Red spider much more in evidence on these trees than on remainder of orchard where lime-sulphur was used exclusively.

24/11/27 : No spot in evidence on trees under test nor in remainder of orchard.

29/11/27 : A few leaves now showing black-spot throughout the whole orchard. Showery morning, fine for spraying in afternoon. A period of showery weather previous to application and also following. Slight scorching of foliage after spray, 29/11/27.

19/12/27 : Observations made showed black-spot more or less on trees under test, and also on remainder of orchard. Foliage 30 per cent. better on Delicious under test than in remainder of orchard.

31/12/27 : Examined trees all through orchard, and found black-spot about equal irrespective of kind of spray used. Foliage 30 per cent. better on Delicious under test than in rest of orchard.

3/1/28 : Weather conditions now set fairly dry.

1/2/28 : Examined all trees. Found black-spot more or less in evidence all through the orchard, but infection very slight. Red mite now much more in evidence on these trees than remainder or orchard where lime-sulphur was used all through. Foliage on Delicious now inferior to remainder of orchard.

COMMENTS.

It will be noticed that at the petal-fall stage only half the Sturmers were sprayed with bordeaux, the remaining half receiving lime-sulphur. The result of this proved only what has been so long recognized—namely, that it is dangerous to follow bordeaux at pink with lime-sulphur at petal-fall.

One outstanding feature was the superior character of the foliage on the Delicious on which bordeaux plus oil was being used until the end of December. However, by the end of January the reverse was the case. Red mite had made such headway that the foliage was

fully 30 per cent. worse than on the remainder of the Delicious. At picking-time the results went to show that there was no advantage in bordeaux over lime-sulphur for the control of black-spot during the past season. The season was not such a bad one for black-spot, and therefore possibly results would be different when meeting a bad season.

The difference in the Sturmers sprayed with bordeaux as against lime-sulphur was very marked. The fruit generally was very much more russeted and also smaller in size. With the Delicious there was no difference apparent in the fruit.

The programme as outlined for the remainder of the orchard was practically carried out. Slight scorching took place with lime-sulphur, 1–10, at green-tip. A slight alteration in this programme is to be made for the coming season.

SEASONAL NOTES.

THE FARM.

SPRING SOWING OF PASTURES.

SHORT-ROTATION pastures are usually sown in the spring, either with oats or barley in September, or rape in November. Perennial rye-grass forms the bulk of the short-rotation mixtures, and it establishes readily enough in the early spring or early summer. In dry seasons the initial establishment of short-rotation pastures is nearly always bad, as the cereal or rape crop, being deeper rooted than the grasses, gets most of the soil-moisture. The only alternative to spring sowing with a cover-crop is to sow alone in the autumn. This adds considerably to the cost of establishment, and does not invariably lead to a better pasture. When sown in the autumn the pasture follows a cereal; in dry seasons or on heavy land it is often difficult to obtain a sufficiently fine, moist seed-bed for sowing in March, and if sowing is delayed until the ground has been weathered by the autumn rains it is often too late for successful establishment of the grasses and clovers.

Permanent pastures are sometimes sown in the spring, and this practice is usual in the far South where the winter frosts are severe. Spring sowing is also common on many North Island dairy farms where the pasture follows a winter rootcrop. Generally speaking, permanent pastures sown in the spring establish best without a cover-crop, and the pasture is best sown some time in September, so that the grasses and clovers may be well established before dry summer weather is experienced. Annual weeds are nearly always bad in a spring-sown pasture, and the weed-growth can be checked by mowing the pasture in November. Sorrel is usually a bad weed in young pastures on light land, and its growth can be checked very successfully by mowing the pasture in November when the sorrel is in flower.

The seed-bed for grass should be fine, moist, and firm. When sown with a spring cereal the grass-seed is usually sown in September,

after the cereal is up in the case of August-sown cereals, or as soon as the cereal is drilled if it is September-sown. In the latter case the land should be rolled after drilling, and the grass-seed and fertilizer broadcast on the rolled surface and covered with light tine harrows.

CROP-PRODUCTION.

Red clover for seed is usually sown with spring oats or barley, or with an autumn cereal which has been fed off in the spring. From 5 lb. to 6 lb. of seed should be broadcast and the seed covered with light tine harrows. Red-clover crops sown the previous year should be well harrowed and top-dressed with superphosphate before shutting up for hay some time in September.

As the autumn-sown cereals are fed off the land should be harrowed, so as to aerate the surface and scatter the clods which have been softened by the winter frosts.

Land for potatoes that has been skimmed in the autumn should be cross-ploughed in readiness for working up and planting in October.

Except in the far South, all spring cereals and cereal and legume mixtures for hay should be got in if possible by the end of August or early in September. If heavy rains are likely in September and the land is at all liable to hold the rainwater on the surface, it is often worth while to delay sowing barley till the end of the month or early October, so as to avoid the danger of the young crop being drowned out.

FEEDING OF DAIRY CATTLE.

September is usually a difficult month on dairy farms. If the weather is cold there is usually little grass-growth until the end of the month, and milking-cows suffer from the want of a sufficiently nutritious diet. Top-dressing in the autumn and shutting up pastures in June allows a good deal of the winter growth of grass to be saved for the spring, but this growth is usually finished by the end of August. Production then falls in September, when the bulk of the milking-cows' fodder consists of pasture-hay or hay and roots. The best hay should always be kept for the spring. Lucerne and clover hay are admirable for milk-production, and where these are not available the best pasture-hay (containing the most clover) should be kept for the spring. Failing the supply of good hay or grass the protein requirements of the milking-cows can be made up by feeding protein-rich concentrates. It is quite possible that the application of nitrogenous manures in July and August, as outlined in last month's notes, will promote a sufficiently vigorous early spring growth of grass to overcome the present difficulties of providing supplementary feed for September.

The winter and early spring feeding of yearling heifers is often very inadequate on dairy farms. The first winter is a most critical period in the life of a young cattle-beast, and its subsequent development depends very largely on how it was fed in early life. Calves should be the first stock to get a ration of hay in the early winter, as it is essential to get them used to hay and root feeding before the grass-growth seriously declines. Supplementary feeding should be continued in the spring until there is plenty of grass, so that the young animals' growth is not checked.

LAMB-MARKING.

Lambs are usually marked when four to five weeks old. Marking should be done during cool dry weather, and care should be taken that the lambs are not heated when marked. Marking during wet weather should be avoided, as it often causes heavy mortality. The operation should be carried out in temporary yards erected in a clean grass-paddock, so as to avoid risk of blood-poisoning. Care should be exercised in holding the lamb, and the hind legs should not be pulled wide apart, as this often ruptures the tissues in the crutch. The lambs should be released in such a manner that they land on their feet, and not so that the severed end of the tail becomes covered with dirt when the lamb reaches the ground. The knives and hands of the operators should be clean, and a tin of disinfectant provided in which the knives can be placed when not in use.

—*P. W. Smallfield, B.Ag., Fields Superintendent, Auckland.*

THE ORCHARD.

SPRAYING OPERATIONS.

It is recognized by all commercial orchardists that theearly sprays up to the blossoming-period are of vital importance for the control of fungoid diseases, and although there is a tendency in some districts to delay the first spray as late as possible this practice is not recommended—anyhow until such time as we have positive proof that the early or green-tip spray is of no value and can be dispensed with. Spores of fungus diseases as well as insect pests are lurking under bud scales, rough bark, dead twigs, &c., and are only awaiting a favourable opportunity to commence their activities. Fruit-trees at this time of the year can stand a much stronger spray than later, therefore a good application early, when the trees are just starting into growth, often prevents trouble as the season advances.

Just when to start spraying must be determined by the orchardists in the different districts, there being, of course, variations from Auckland to Bluff. The most important point is to be ready with all appliances in good order, so that no time is lost when spraying actually commences. Thoroughness is the keynote to success, and every care should be taken that all exposed surfaces are covered with the spray, since any portion missed may mean an open port of entry for disease. Many growers, knowing that spraying is a more or less disagreeable job, are apt to rush the work, and they then sometimes wonder why the results are not as good as those of the next-door neighbour who sprayed with the same mixture at the same time. Rather aim at spraying 5 acres per day properly than 10 acres just to get the work over. Weather conditions also play an important part in spraying operations. Should rain follow directly after spraying, it is advisable to repeat the operation, the main object being to keep a thin film of spray over every part of the tree.

Spraying programmes vary with the different districts and according to climatic conditions; consequently it is almost impossible to lay down any hard-and-fast rule suitable for the whole. If a grower has been successful in previous seasons with a certain programme he may be advised to adhere to it. On the other hand, if he is not getting the results desired the advice of the Orchard Instructor for the district should be sought.

The use of red oil at the dormant or bud-movement period is a very debatable point with growers, many claiming that the results obtained do not justify the use of such an expensive spray every season. However this may be, there is no doubt that it is a very beneficial spray, both for keeping insect pests in check and for the general good of the tree. Consequently it should be used at least periodically, at strength 1-15–25, according to advancement of the buds.

Many growers prefer a good bordeaux spray at the green-tip stage, especially on varieties such as Delicious and Sturmer. As there is no fear of russeting at this period, bordeaux at strength 6–4-50 can be used with safety. If lime-sulphur is preferred, 1–20 to 1-25 at the same period should be used. Owing to the chance of russeting with bordeaux it is advisable to switch over to lime-sulphur after the first spray, using a 1–40 solution at the open-cluster period.

Bordeaux is recommended for the control of black-spot on pears—an application of 6-4-50 at the green-tip stage, followed by 3–4–50 from the open-cluster to the pink period. An exception may be made with the Winter Cole, P. Barry, and Josephine varieties, using 1–60 lime-sulphur at the pink stage in preference to bordeaux.

For the control of leaf-curl, shot-hole, &c., on stone-fruits a thorough application of bordeaux at strength 6-4–50 when the buds begin to swell is recommended. This should be followed by either bordeaux, 3–4–40, or lime-sulphur, 1-50, at the pink stage. It is claimed by many that lime-sulphur at the pink stage is a great factor in the control of brown-rot, and consequently it should not be neglected, as this disease probably takes more toll than any other trouble stone-fruits are subject to.

CULTIVATION.

Early cultivation of the orchard is as necessary and valuable as the early spraying, and if the annual ploughing has not already been done it is advisable to attend to it as soon as the soil is in a fit condition. Where late autumn ploughing was done, with the intention of cross-ploughing in the spring, the operation may be deferred for a short time, but it is essential that the work should be completed before the trees start into growth and spraying operations commence. Cultivation round the trees, where it is impossible to work with the plough, is sadly neglected in many orchards. Trees dug or hoed round at this time of the year, turning under all sods left by the plough, dead leaves, rubbish, &c., will require very little further attention during the season, as the disks or harrows will keep the soil fairly clean. Turn in cover-crops about this time, giving the green material every chance to rot before the dry weather sets in.

MANURING.

It is only during the past few seasons that systematic manuring has been carried out in many orchards. Growers are realizing that it is impossible to get the best crops every season without returning to the soil plant-food taken out during the growing-period of the tree. Probably the latter part of August or the beginning of September is the best time to apply manure in the orchard, thus allowing the rains at that period to take it down into the soil. Each orchardist should find out what are the requirements of his orchard as far as manure is concerned, and apply it accordingly. By the growth of the tree, leaf-surface, fruitfulness, &c., a good idea can be formed as to whether phosphates, nitrogen, or potash is needed. Liming is also usually a beneficial adjunct to manure, and the application of 1 ton per acre every few seasons should not only tend to improve the soil, but make available much plant-food lying dormant.

—*G. Stratford, Orchard Instructor, Motueka.*

Citrus-culture.

The coming month is the most suitable period of the year for planting out all varieties of citrus-trees. There are instances where plantations set out as late as October or November have succeeded quite well, but in a general way September may be considered the best month. Fair rainfall may be expected to keep the young trees going, and the spring conditions are conducive to early establishment.

Possibly the most important factor in planting is that the soil should be in good condition, is well worked, friable, and not by any means sticky when worked to plant the trees. Trees should be firmly planted with the roots well spread. It is not feasible to plant firmly unless the soil can be compressed without sticking together, while to spread the roots well means breaking up the hard compacted ball of earth consolidated round them as usually received from the nursery. The subsoil immediately under the tree should not be disturbed to a greater depth than the surrounding subsoil, and though the soil should be firmed round the spread-out roots the top 2 in. of surface soil should be left loose.

Fertilizers may be worked in round the newly planted tree or mixed with the soil used to refill the hole, but they should as far as possible be kept from direct contract with the roots. Should the situation be in any way exposed the plants should be supported with a strong stake inclined towards the prevailing wind. The stake, not the tree, should be bound with sacking to prevent chafe.

Varieties recommended for planting are as follows :—

Lemons.—Lisbon : The well-known variety ; a thorny tree of constant cropping habit, the heaviest crop usually being harvested in late winter. Eureka : Equally desirable and fruitful as Lisbon, though the main crops are harvested in summer. Meyer : A newer variety of great promise ; should be tried in a limited way ; it is said to be more frost-resistant than other varieties.

Oranges (preserving).—Poorman : Generally succeeds quite well wherever citrus-fruit can be grown ; heavy and constant cropper of

medium to large fruits, the largest of which may be used as breakfast fruits ; in season from May to September.

Oranges (*sweet*).—Navelencia : A naval of late season. Valencia Late : A Valencia navel of late season. Both these varieties under general conditions give a great range of sizes, many of which are below commercial size.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

BROODER TROUBLES.

MANY poultry-keepers have sought my advice as to the poor results and troubles encountered in the artificial rearing of chickens, but with few exceptions the correspondents have failed to give full particulars relative to the special conditions under which the young birds are being reared, while, worst of all, no mention is made as to the particular make of brooder they are using. Thus it is next to impossible to even suggest the probable cause of the trouble.

There are now so many different styles of brooders and methods of working them that any instructions given in these notes or by letter could not be applied generally. Correspondents when asking for advice regarding the troubles they encounter should always give the name and the particular style of brooder they are using. Without these details it would be merely guessing on my part to express an opinion with any degree of certainty as to the probable cause of failure. Usually my correspondents merely give a few particulars relative to symptoms, such as droopy wings, &c.—symptoms which manifest themselves in affected chicks from almost any cause. On the other hand, in most cases the correspondents give full details relative to the food provided, thus indicating that in their opinion the food alone is responsible for the chicks' failure to live. For the successful rearing of chickens good food is always essential, but this is only one important link in the chain of management. The best food ration ever planned will not spell success if other essential details are neglected.

It is safe to say that chill is responsible for the loss of more chicks than all other things put together. For example, if chicks become chilled bowel trouble soon appears. Once this disorder sets in little or nothing can be done to save them, and it will generally pay in the long-run to destroy all chicks so affected rather than try to doctor them. In addition to bowel trouble there are other signs indicating chill, such as huddling, droopy wings, a distressed chirp, excessive thirst, and no inclination to leave the brooder or to eat. To prevent chill the brooder should be maintained at a more or less uniform degree of temperature, but it should be so arranged that the chicks are given an opportunity of moving away from the heat when it is excessive : Generally, if given the opportunity, and of course where they are not overcrowded, they will secure the degree of warmth that instinct demands.

Where brooders of the canopy type are used the chicks are afforded an opportunity of moving to and from the main source of heat, and securing a desired degree of temperature. It is true, however, that

even with this class of brooder the chicks will sometimes crowd into corners of the house, rather than remain in close reach of the brooder. The cause of this behaviour is usually put down to excessive heat in the brooder-room. Generally, however, it is due to a ground draught. Fresh air is of equal importance to desired warmth, but above all things it must be provided without draught. If there is a draught from any particular quarter the chicks will gradually move away from it until the corner is reached, indicating that they prefer to leave the chief source of heat (so essential for their welfare) rather than remain in a draught.

The huddling brings on a sweated condition, and this is fatal to chicks at any time. As a preventive I would advise placing on the floor of the house a board—say, 1 ft. high—a few feet away from the brooder, as a draught-break. If the behaviour of the chicks is observed the direction from which the draught is coming will soon be detected, so that the board or boards, as the case may be, can be placed in the right position. Of course, care must be taken that the chicks are given sufficient space to move well away from the heat when this is excessive, a condition which may easily happen when warm weather prevails. Chicken-rearing is a business of little details, and if these are not observed in every respect the best results cannot possibly be achieved.

The importance of cleanliness in the management of brooder chicks cannot be overestimated. Dirt means disease, infection, and the presence of vermin, and once these make their appearance mortality may be expected. The quarters should be kept sweet and clean by frequently renewing the bedding and litter material. Before new batches of chicks are moved to the brooder the whole of the quarters should be thoroughly cleaned and sprayed with a weak solution of sheep-dip or other suitable disinfectant. On no account overcrowd the brooder; it is one of the things which never fail to give trouble. It is always a safe policy to have too few chicks in the brooder than too many.

FEEDING OF CHICKS.

While a uniform degree of warmth, plenty of ventilation without draught, and strict attention to cleanliness are the chief factors in rearing brooder chicks, the matter of providing the right class of food must not be overlooked. There are numerous mixtures that will give equal results. The main point is to feed sound, wholesome food. Dry, coarse oatmeal is ideal for the first few meals. This may be followed by a reliable brand of chick-raiser. During the early stages it is a good plan to slightly moisten the broken grains with sweet milk or hot water some time before using. This will make the food more easily digested. Few people realize the value of dry coarse bran for young chicks. Right from the start it should be in reach of the little birds to pick at. An important point in rearing brooder chicks is to keep them well exercised. The best way of inducing this is to feed some chick-food in the litter and make them scratch for it. Grit, charcoal, and clean water should always be in easy reach right from the first, while finely cut succulent green material should be fed daily after the third day.

GIZZARD COMPACTION IN CHICKENS.

Many poultry-keepers make the mistake of not conducting a post-mortem examination on any chicks that die, for the purpose of ascertaining, if possible, the cause of death. Such examinations often give clear proof of the cause and nature of the trouble, and indicate preventive methods. Thousands of chickens die annually through eating long fibrous green material which rolls up in a tangled mass and will not leave the gizzard. The pickings from curtains, sacking, &c., will have a similar effect. Much mortality also takes place when they are supplied with grit or bedded with sand containing a large proportion of glittering mineral particles, which they pick up. These particles accumulate in the gizzard, and death rapidly follows. Many of the brooder losses could be prevented if these injurious substances were kept out of reach of the motherless chicks that have not attained the age when they can be trusted to look after themselves.

Some of the so-called wheat pollard containing a high proportion of fibrous material, such as finely ground husks, is also often responsible for gizzard compaction and its evil effect. Although finely ground, the fibrous material contained in the pollard will not leave the gizzard. As a result this organ becomes packed to its utmost with the fibrous substance, and consequently the chickens die from starvation. Young chicks have not the power to assimilate hard fibrous material, however finely it may be ground. Obviously, to compel them to eat any mixture containing a high proportion of this material is simply courting disaster. Unless pollard is known to be the genuine article it should never be included in the ration for birds of any age, and particularly is this the case where growing chickens are concerned.

The joints from grain-stalks are often eaten by chicks when bedded with chaff, causing gizzard compaction and finally death. This trouble may be minimized by giving the little birds a light meal before leaving the incubator. After securing a dainty meal the chicks will be less inclined to pick up any fibrous matter that may be in reach of them when transferred to the brooder. Much of the trouble due to gizzard and crop compaction would be avoided—whether it be with old or young stock—if sharp gravel grit were always available for the birds to pick at. It is true that some birds under certain local conditions will do well on broken sea-shell alone. In a general way, as a preventive of digestive troubles, sharp gravel grit is always advisable.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

SPRING WORK.

WITH the advent of spring weather no time should be lost in pushing on with essential work not already completed. Repairing and painting old hives, provision for increase, laying in stocks of foundation, and making and wiring frames should be taken in hand. Neglect to pay attention to these important matters leads to heavy losses each successive season. A surplus stock of supplies should be kept in anticipation of a honey-flow and increase at swarming-time, not

only by the commercial apiarist but also by the small beekeeper producing honey for home consumption. The successful apiarist makes sure that he has on hand plenty of spare equipment to carry the work through the summer season. Some idea of what is required may be gained by observing apiaries in operation.

Every advantage should be taken of the fine spring days to examine each colony for the purpose of noting the quantity of stores, the general condition, and whether queenless or weak. If the examination reveals plenty of stores in the combs all will be well, but, if not, artificial feeding will be necessary to carry the colony through until sufficient honey is coming in from the fields.

Fruit and willow blooms are a considerable help, but must not be relied on absolutely to starve off starvation, as climatic conditions are not always favourable to the flight of the bees. In any case nectar from these sources will not always suffice for the needs of the bees, except under favourable conditions (and then in few localities) where willows are plentiful. When brood-rearing has commenced in earnest the food-supply must be kept in mind, and periodic examinations undertaken to see that the stores do not give out before the arrival of the clover-bloom. If the colonies are weak in bees little advantage is gained in trying to pull them through until the hives are populous. By far the best practice is to unite them with stronger colonies, as there is a danger of weak colonies being robbed out. The surplus stores can be distributed among those in need of them. If on the first examination queenless hives are found these should be united at once, as it is yet too early to rear queens and get them successfully mated. Queenless hives promote wholesale robbing, and on no account should be tolerated during the spring months when there is a dearth of honey.

FOUL-BROOD.

Another important seasonal matter is keeping a constant lookout for signs of disease. Any colonies in an unhealthy condition should be marked for treatment during the first flow of honey. Every precaution should be taken with colonies that are affected with disease to prevent them from being robbed. Do not leave hives or their inside fixtures in exposed positions after they have been in contact with disease, or visiting bees may be the means of spreading the trouble to healthy colonies. At all times the beekeeper's efforts should be in the direction of keeping his colonies strong and healthy.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE TOBACCO CROP.

A FURTHER sowing of tobacco-seed towards the end of August is usually good policy. By having a part of the crop a fortnight or so later than the remainder, the planting season, as well as the harvest, is spread over a convenient period, and the work is done better than

when it has to be either rushed through or much of it is done when the plants are past their best condition. Light crops and poor cures are very commonly due to the plants being soft, blanched, and overgrown when planted out, and to much of the leaf being over-ripe when harvested. Those growing an experimental crop will find a small second sowing now an insurance against accident from weather, disease, or inadvertence.

Early September is the time for pricking out the first of the seedlings into the seed-beds. If the seedlings arrive from the nurseryman in boxes it will be as well to keep them undisturbed in a scrim-covered cradle so as to thoroughly harden them before planting out. During the earlier part of this period they should be kept a little drier than usual.

The operation of pricking out the seedlings is conveniently done by two persons, one on each side of the 4 ft. seed-bed. With a thin, narrow board of hard wood, a little shorter than the width of the bed, and having a bevelled edge, a cut 1 in. or so deep is easily made in the prepared friable soil: the seedlings are then lifted, placed against the perpendicular cut face, and the soil is then drawn up to complete the covering of the roots. When a row is planted the covering is completed and pressed firm with the board, and another started as before 1½ in. from the last. A light watering with a fine rose will settle the soil about the plants, which should then receive the shade and protection of cheesecloth stretched and fastened over the bed. A thin hessian will serve the purpose, but a close woven fabric is unsuitable, as owing to the lack of air the plants are liable to damp off. The cloth should be supported by cross-timbers to keep it from sagging. Where only a few plants are being grown they should be pricked out 1 in. or so apart in shallow tray boxes, lightly watered, and put back in the frame to be further grown.

While the seedlings are being grown the land in which they are to be planted out should be undergoing preparation. While the most suitable soil for the tobacco crop is not the richest and heaviest, but a medium-light friable soil, it should be ploughed early to turn in grass and weeds to rot, and afterwards receive cultivation from time to time to destroy seedling weeds. This working will also destroy insects pupating in the soil, or uncover them for the benefit of the birds, which busily search freshly turned land. Such preparation is the best method of preventing the depredations of surface caterpillars or cut-worm—the larvæ of various moths—which sometimes cause wholesale losses by cutting off the young plants at the surface of the ground soon after they are put out; or wire-worm, the larvæ of click-beetles, which feed voraciously on the roots of young plants and prevent them growing. Good and timely preparation of the land will greatly facilitate and cheapen production in the field. The quality of the leaf is best where the soil is in sweet condition. If necessary, apply a good dressing of lime directly after the first ploughing.

TOMATOES.

The tomato crop under glass requires skilful nursing during the spring months if the more valuable early crop is to be gathered in good quantity and condition. If the plants stop growing, or if they

receive a check of any kind, the early crop is going to suffer. Damage of this kind is usually caused through careless ventilation or watering. Give these two operations carefully studied manipulation, and the plants an application or two of bordeaux to keep the bottom foliage right, and there should be little trouble. Also, do not cultivate too deeply now—only just deep enough to keep the weeds down.

Plants for the main outdoor crop will soon be ready for pricking out. Do this when the first rough leaves develop, rejecting all poor and abnormal types. Careful culling should be done at this stage; put the plants back in the frames and grow them on steadily. Remember high temperatures now do almost as much damage as low ones, and carefully attend to ventilation. Prepare the land now for planting out. Turn in the cover-crop, if one is being grown, so that it will have ample time to rot. Good preparation takes time as well as labour.

SMALL-FRUITS.

Brakes of small-fruit bushes or strawberries will require shallow hoeing in bright weather to kill weeds, and such sprays as are necessary to keep them clean. "Leaf-spot" of various kinds is very apt to be troublesome now on the foliage of all classes of berry fruits, and good 4-4-40 bordeaux is the best preventive. Under our system of culture most crops will benefit from a dressing of chemical fertilizers now. Give the formula careful consideration. Stunted plants would benefit from the inclusion of a little ammonia, but at this season it is better to give too little rather than too much of that ingredient, especially to herbaceous plants that are very responsive.

VEGETABLE CROPS.

As crops of winter cabbage, broccoli, &c., are now used up, the land should be taken in hand without delay and prepared for the next crop. Such land is generally in excellent condition for root crops, after suitable cultivation. Cabbage, cauliflower, and lettuce planted out in late autumn and early spring for spring cutting will now be making growth, and may be fed with nitrates as required.

Asparagus and rhubarb are important crops now being harvested. To enable the plants to do their best give them a dressing of suitable manures. For the asparagus crop a mixture composed of three parts common salt, two parts superphosphate, two parts nitrate, and one part sulphate of potash would be suitable in many instances, applied at the rate of 2 oz. per square yard or 5 cwt. per acre. Following the winter dressing of organic manures the rhubarb crop should now be given 3 cwt. superphosphate and 2 cwt. nitrate of soda per acre.

The present is a suitable time for making new plantations of asparagus. For commercial crops the land must be light, rich, and moist. Put out one-year-old plants 18 in. apart with 3 ft to 4 ft. between the rows. Cover the roots with 2 in. to 3 in. of soil now, but plant sufficiently deep so that when the furrow is completely filled the crowns will be at least 5 in. beneath the surface; plant firmly. New plantations of rhubarb are usually made in summer after the spring crop is gathered.

The planting and sowing of all the remaining hardy annual main crops should now be completed. Take advantage of bright dry weather to hoe seedling crops, and in dull showery weather thin them out. Prepare land for the half-hardy crops to be sown and planted at the end of October and beginning of November, and for seed-beds for winter vegetables to be sown next month.

THE FARM-GARDEN.

House supplies on the farm are often grown, fruit and vegetables together, with but little success. Some intercropping between fruit-trees may be done successfully while the trees are small, but as soon as they are big enough to bear, or even before that, intercropping with vegetables should cease, as it is mutually unsuitable. This is particularly bad when the trees are planted rather close together. A good method often is to plant the main vegetable crops out in a nearby paddock with the farm root crops. Peas, potatoes, cabbage, onions, &c., may be grown very well in this way with horse implements. The enclosed garden near the house can be used with advantage for such permanent crops as asparagus, rhubarb, herbs, and bush fruits; also annuals such as tomatoes and salads; and for seed-beds where plants may be grown before putting them out in the field. This can be a very useful and interesting little section if it is sheltered and well managed. With a garden-house containing a few chemical plant-foods and specifics, also suitable implements, this is a section that could be very well managed by ladies who have a taste for gardening.

—*W. C. Hyde, Horticulturist, Wellington.*

ROSELLA PARAKEETS.

Of late years a small Australian parrot called Rosella has become established in the Waitakere Ranges, near Auckland. The birds are often seen in orchards and gardens within a few miles of the Waitakeres, and are reputed to do considerable damage. It is considered desirable that they should be exterminated if possible. They may be shot at any time of the year without a license, and are good eating. The Department of Internal Affairs has decided to grant no further permits for the importation of these birds.

BOOKS RECEIVED.

New Zealand Trees and Shrubs and how to Identify them. By H. H. Allan, M.A., D.Sc., F.L.S., F.N.Z.Inst. Whitcombe and Tombs, Ltd., Christchurch, &c. 6s. 6d.

Cawthron Lectures, Volume III. The Cawthron Institute, Nelson.

The Sheep and Wool Industry of Australia and New Zealand. By Henry B. Smith; revised in conjunction with Harold Haile. Third edition. Whitcombe and Tombs, Ltd., Christchurch, &c. 10s. 6d.

Imperial Agricultural Research Conference, 1927: Report and Summary of Proceedings. His Majesty's Stationery Office, London. 1s.

The Pig Breeders' Annual for 1928–29. The National Pig Breeders' Association, 92 Gower Street, London W.C. 1. 2s. 6d.

EXPORT OF EGGS, 1928 SEASON.

CONDITIONS OF GOVERNMENT GUARANTEE.

THE conditions under which the New Zealand Government offers a guaranteed return on eggs shipped from New Zealand to London are as follows :—

1. The guarantee is only available to the producer of the eggs, and refers only to shipments of hens' eggs made to London during the 1928 season.

2. The guarantee is that the Department of Agriculture will pay to the New Zealand Poultry Association, as soon as practicable after account sales for all shipments for the season are received by the Department, such sum as is necessary to enable the association to pay to the producer an amount sufficient to make the average gross wholesale price received by him on the London market not less than £3 5s. per case for his proportion of the shipments under the guarantee throughout the season. Thus the price for individual cases or shipments is not guaranteed, but an average of not less than £3 5s. per case for each producer's total shipments is assured.

3. The guarantee is limited to eggs produced and shipped (otherwise than under an f.o.b. contract) by poultry-keepers or co-operative associations of poultry-keepers ; shipped through the New Zealand Poultry Association to London agents approved by the Department of Agriculture after consulting the association ; and adequately insured against fire and marine risks from the time of shipment till the time of sale, to the satisfaction of the Department of Agriculture.

4. The eggs shall be sent to one of the grading-stores referred to in clause 6 of these conditions, graded for size, and packed in strong clean cases with card-board fillers or other suitable carriers, so as to prevent damage in transit to the grading-store. The tray-system case is recommended. The eggs shall not be packed in chaff.

5. The eggs shall weigh not less than 2 oz. each, and shall not have been preservatized or refrigerated. They shall be clean and free from stain, non-fertilized, normal in shape, uniform in size, and sound in shell, and shall have the air-cell less than $\frac{3}{16}$ in. in depth.

6. Each consignment shall be submitted at the store by or on behalf of the producer to the manager of one of the grading-stores arranged for by the New Zealand Poultry Association, and approved for the purpose by the Department of Agriculture. There shall be delivered to the manager with each consignment a written advice of the number of cases and eggs contained therein, together with a distinguishing mark or brand, such advice to be available for the information of the grader as required.

The eggs shall be graded and repacked as provided for in clause 8, and the grader shall, on the form provided, advise the manager of the number of eggs passed for export, and the manager shall thereupon advise the consignor.

7. The manager shall be accountable for all eggs rejected for export, and shall notify the producer, or any agent nominated by the producer, when such eggs, together with the cases, carriers, &c., used in transit to the grading-store are available for delivery.

8. All eggs so submitted for export shall be individually examined by or under the direction of the Department's grader, and those passed by him shall be repacked to his satisfaction into new cases (as described in clause 10 of these conditions) supplied by or on behalf of the producer. No fee will be charged for the personal services of the grader, but the producer shall arrange with the manager to provide the assistance required by the grader, to the latter's satisfaction. All charges connected therewith, including taking delivery of the eggs, use of the grading-store, packing, provision of cases and fillers, storage, shipping, freight, insurance, and marketing shall, unless otherwise arranged for by the producer, be borne by the association and charged to the producer, *pro rata*.

9. The standard cases into which all eggs for export shall be repacked shall be supplied by the producer, shall be made of clean, dry, odourless wood, and shall comprise two compartments, each of $11\frac{3}{4}$ in. by $11\frac{3}{4}$ in. and 13 in. high (inside measurements). The ends and partition shall each be of one board measuring $11\frac{3}{4}$ in. by 13 in. by $\frac{5}{8}$ in., both end boards to be dressed on the outer

side. The top and bottom shall be of boards of 25⅜ in. by 6 in. by ⅜ in., and shall be nailed flush with the sides of the case, leaving a space of ½ in. in the middle. The sides shall each be of three boards, 25⅜ in. by 4 in. by ⅜ in., and shall be so nailed as to leave spaces of ½ in. each between the middle and outer boards. A wooden cleat of 12½ in. by 2 in. by ⅜ in. shall be nailed to each end of the case so as to be level with the top of the case and to project ⅜ in. therefrom.

Each case shall be fitted with new, heavy, dry white manila-board fillers and flats, with pads of kiln-dried wood-wool approved by the grader, one of these pads being placed in each section at bottom, centre, and top of case.

Each case shall be branded with the expressions "New Zealand Eggs" and "30 dozen" in black letters not less than 2 in. in height, on each side, and with the name and shipping-mark of the exporter on one end, the other end being reserved for a label, with sufficient clear space for the grader's stamp. The weight per long hundred of each case shall also be stamped on each end.

10. All eggs shipped under the guarantee shall have been passed for that purpose by the Department's grader, a certificate to that effect obtained from the grader by the shipper, and the cases stamped by the grader to show that the eggs therein have been passed.

11. No eggs passed by the grader for shipment shall be removed from a grading-store except to be forthwith shipped to London, or to be placed and held, with the approval of the grader, in cool storage prior to such shipment.

12. All eggs coming under the guarantee shall be carried on the ship in cold storage under conditions suitable for keeping them at a temperature of about 34° Fahrenheit.

13. If any eggs, after being graded and prior to their export from the Dominion, become damaged, or, in the opinion of any grader, deteriorated from any cause whatever, the owner of such eggs shall, if and when directed by the grader so to do, submit such eggs for re-examination, and surrender to the grader the grade certificate issued in respect thereof.

14. The Government reserves the right to withhold the guarantee from eggs shipped in vessels the cold-storage facilities of which are deemed by the Department of Agriculture to be unsatisfactory for the carriage of eggs, or from eggs forwarded for grading at times other than those arranged between the New Zealand Poultry Association and the Department of Agriculture, such times to be in no case later than 15th November, 1928, unless in exceptional circumstances the Department agrees to a later date.

GRADINGS OF BUTTER AND CHEESE, SEASON 1927-28.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the twelve months ended 31st July, 1928 (the dairy industry year), were as follows :—

Butter: Salted, 71,605 tons; unsalted, 3,118 tons: total, 74,723 tons—an increase of 4·2 per cent. compared with the figures for the preceding twelve months.

Cheese: White, 49,415 tons; coloured, 26,338 tons: total, 75,753 tons—a decrease of 0·73 per cent.

In butterfat equivalent the 1927–28 amounts for butter and cheese combined represent a net increase of 2·59 per cent. compared with those for 1926–27, hitherto the peak year. A new high-level record in butterfat production has thus been established.

Review of "Plant Hunting."—In Dr. L. Cockayne's review of E. H. Wilson's book "Plant Hunting," in last month's *Journal*, it was stated that the number of pages in the book was 276, whereas there are 524. The mistake arose from the fact that each volume of the work is paged separately—an unusual proceeding—and that the reviewer looked for the total number of pages at the end of the second volume, and concluded that number (276) referred to the whole work.

WEATHER RECORDS: JULY, 1928.

Dominion Meteorological Office.

GENERAL NOTES.

There was a marked contrast, as regards rainfall, between the weather experienced during the month in Auckland Province and that enjoyed by the remainder of the Dominion. Except for part of the Bay of Plenty district, the rainfall was considerably below normal over most of the northern province, and there were heavy floods in North Auckland and the Waikato and Waihou Valleys.

Approximately average falls were received over much of northern Taranaki, Nelson, and Marlborough, and in parts of central and southern Otago and Southland the registrations were in excess of the average. In all other districts south of Auckland the month was a dry one. The shortage of rain was very pronounced in Canterbury, especially in the northern part of the province.

In the first half of the month there were some fairly general rainfalls and the weather was at times stormy, but thereafter fine weather was the rule in all the central and southern provinces. In contrast with June, temperatures were everywhere remarkably mild. Frosts were numerous in the South Island but seldom severe, and there was a marked absence of snowfall except at very high levels. Sunshine was more abundant than usual. The absence of westerly winds was no less marked than in the preceding months of the year.

The rainfall of the month was associated chiefly with three cyclonic storms. The first of these moved from the Tasman Sea towards the Auckland Peninsula on the 7th, and, moving thereafter in a more southerly direction, crossed the South Island on the night of the 8th. General rain fell between the 7th and the 9th, with heavy falls in many parts. In North Auckland, where the precipitation was heaviest, there was heavy flooding in the rivers. Gales were caused in many places by this storm.

The second of the cyclones mentioned moved slowly from the North Tasman Sea and away eastward across the Auckland Peninsula between the 22nd and the 25th. On this occasion the heaviest rains fell in the Waihou and Waikato River Valleys, and serious floods reached their culminating-point on the 24th or 25th. In parts of the Waihou watershed the flood was a record one. At Waihi, for the four days ending at 9 a.m. on the 25th, a total rainfall of 19·80 in. was recorded. This storm produced comparatively little effect south of New Plymouth and Gisborne.

The third cyclone followed a somewhat similar track between the 29th and the 31st. It was of smaller area than the preceding ones and its effects still more restricted. There were some heavy rainfalls, however, in the Thames, Coromandel, and East Cape districts, and rivers were kept in a flooded state till the end of the month.

Though each of these storms was responsible for gales in places, they were not, as a rule, prolonged, and comparatively little damage was done by them.

In the South Island the prevailing winds were from the south-west, and in exposed positions they were occasionally strong.

—*Edward Kidson, Director of Meteorological Services, Wellington.*

RAINFALL FOR JULY, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average July Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	6·48	11	2·90	5·96
2	Russell	5·79	13	1·37	4·97
3	Whangarei	10·36	15	2·90	7·26
4	Auckland	8·53	24	2·22	4·98
5	Hamilton	5·59	13	2·04	5·02
6	Kawhia	6·84	14	2·04	6·16

RAINFALL FOR JULY, 1928—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
	North Island continued.				
		Inches.		Inches.	Inches.
7	New Plymouth	7·31	13	2·21	6·29
8	Riversdale, Inglewood ..	9·76	16	3·12	9·93
9	Whangamomona	6·94	9	2·05	7·35
10	Eltham	5·61	15	2·35	5·55
11	Tairua	14·40	14	4·59	5·25
12	Tauranga	5·17	15	1·06	4·86
13	Maraehako Station, Opotiki	3·24	10	0·96	4·09
14	Gisborne..	5·19	17	1·53	5·14
15	Taupo	4·26	9	2·16	3·83
16	Napier	1·44	16	0·41	3·90
17	Maraekakaho Stn., Hastings	2·33	19	0·50	3·05
18	Taihape	1·56	13	0·44	3·15
19	Masterton	0·99	16	0·26	4·31
20	Patea	2·55	10	1·58	4·20
21	Wanganui	1·11	6	0·60	3·52
22	Foxton	2·16	9	..	3·09
23	Wellington (Karori Reservoir)	3·70	13	1·45	5·22
	South Island.				
24	Westport	6·33	17	1·12	6·99
25	Greymouth	4·26	16	0·87	7·84
26	Hokitika	6·26	17	1·60	9·08
27	Ross	6·49	10	0·98	9·94
28	Arthur's Pass	9·16	11	2·28	11·55
29	Okuru, Westland	10·12	10	2·10	12·03
30	Collingwood	9·75	13	2·71	9·05
31	Nelson	3·20	5	1·88	3·49
32	Spring Creek, Blenheim ..	3·57	6	2·27	3·40
33	Tophouse	3·31	10	1·02	4·79
34	Hanmer Springs	0·99	9	0·21	4·59
35	Highfield, Waiau	0·32	3	0·20	3·44
36	Gore Bay	0·28	2	0·25	2·84
37	Christchurch	0·48	8	0·16	2·76
38	Timaru	0·42	9	0·22	1·93
39	Lambrook Station, Fairlie ..	0·56	4	0·22	2·61
40	Benmore Station, Clearburn	0·78	8	0·28	1·73
41	Oamaru	0·64	7	0·33	1·74
42	Queenstown	1·84	5	0·58	2·04
43	Clyde	1·54	5	0·52	0·94
44	Dunedin..	1·38	11	0·33	3·01
45	Wendon	2·12	10	0·48	1·79
46	Gore	2·54	14	0·78	1·94
47	Invercargill	3·60	17	0·68	3·28
48	Puysegur Point	8·93	10	1·06	6·18
49	Half-moon Bay, Stewart Is.	4·84	13	0·81	4·13

Weight of Sheep and Lamb Carcasses exported.—The average weights of mutton and lamb exported during the past season to 30th June, as compiled by the Meat Producers' Board, are as follows (figures for the season 1926 27 being added in parentheses): Wethers, 56·7 lb. (55·9); ewes, 55 lb. (54·5); lambs, 34·6 lb. (34·8).

Wellington Winter Show.—The dates for this show (which has been retarded by lateness in construction of new buildings) are now fixed for 19th September to 6th October next.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

AMPHISTOME WORMS IN COW'S STOMACH.

"FARMER," Kaikohe :—

On opening up an old cow, which we killed and boiled up for the pigs, I found masses of worms adhering to the lining of the stomach and mixed with the contents. The worms were the colour of ordinary ground-worms, about ½ in. long, thick at one end and thin at the other. The thick end would be as thick as a slate-pencil, while the thin end came to quite a sharp point. I should be glad of any information about them—cause, cure, &c.

The Live-stock Division :—

These worms are technically known as *Amphistoma conica*, and belong to the fluke family of parasites. The life-history of these parasites is not known in detail, but it is believed that they do no appreciable harm to their host. Diagnosis of the presence of these parasites is impossible under ordinary conditions, and, if diagnosed, it would be a difficult matter to kill or expel them, owing to the large amount of material in the paunch of cattle and the consequent dilution of any drug used for such a purpose. No deleterious effect having been known to be due to these amphistomes, medicinal treatment for their removal is not advocated.

TUNG-OIL TREES.

A. C. MAISEY, Redwood's Valley :—

Can you tell me what chance the tung-tree (*Aleurites cordata*) would have in the Nelson District ? Is it grown from seed, cuttings, or plants ? And how and where they could be procured ?

The Horticulture Division :—

It is most likely the tung-tree would do very well in the Nelson District, and the Department of Agriculture is now raising trees with a view to testing the question. If this trial is successful there should be ample material for propagation and extending the plantings. There are a number of species of *Aleurites*, some of which are inferior and others quite unsuitable for commercial oil production. *Aleurites cordata*, the species mentioned by you, is one of that class.

HEATING OF TOMATO-HOUSE.

WILSON BROS., Otekaike :—

Will you please let us know which is the best way—taking cost into consideration—to heat a tomato-house 40 ft. long by 16 ft. wide ; also where the pipes are placed, &c. Electricity is available.

The Horticulture Division :—

Economical heating of the small tomato-house you describe would depend very much on the season of ripening the crop. To ripen in November and December a few small electric radiators or kerosene-stoves would provide protection against a hard late frost, and with careful manipulation of the ventilators this plan should be quite satisfactory. For earlier crops more heat would be required, but such crops are rarely payable, owing to the Cook Islands supplies, which are even now on the market. This class of heating would require 4 in. cast-iron pipes best laid once round the house just inside the foundations. Whether fuel or electric current should be used would depend on the price of the latter and the hours you were allowed to use it. The electrical system has the further advantage of great simplicity, and the work of stoking and the cost of buying and installing a boiler and furnace is dispensed with.

METHODS OF MILKING.

W. T. LOCK, Okoia :—

Would you let me know if it makes any difference milking the back quarters of a cow before the front ones? Does it drive the milk to the back quarters; and, if so, why?

The Live-stock Division :—

It makes no material difference whether the back quarters are milked first. As there is little communication between the fore and hind quarters of the udder on the same side, the secretion in the one quarter is not influenced to any great extent by that in the other. At the same time the usual practice in hand-milking is to remove part of the milk from the two back quarters, followed by part from the fore quarters, or *vice versa*, until the udder is emptied.

THE JAPANESE WALNUT.

J. D., Okoia :—

I have a few trees, about ten years old, which I bought as Japanese walnuts. They bore this year for the first time. The nuts are in clusters like bunches of grapes and very small, not worth using. Are they likely to increase in size, or are the trees only ornamental? The trees are beautifully shaped, and would make good shade in a paddock for stock, but I am afraid I got the wrong sort.

The Horticulture Division :—

From the description given, your trees are no doubt true to name. The Japanese walnut that has been distributed is very ornamental and useful as a shade-tree. The nuts, however, are very disappointing for edible purposes.

BLACK-CURRANT BUSHES FORMING NO FRUIT.

C. ELLIS, Hunterville :—

My black-currant bushes flowered well last spring, but no fruit formed. The bushes are young and vigorous growers. Can you give me any explanation? There were no heavy frosts.

The Horticulture Division :—

If your black-currant bushes are young, vigorous, and blossomed well, but set no fruit, it is probably due to a check of some kind given them at the time of fruit-setting. What caused this one can only guess. You are advised, however, to avoid deep cultivation that may disturb the roots during the spring and early summer.

WARTS ON COW'S TEATS.

C. D. SUTTON, Te Horo :—

Is there any cure for warts just forming on a cow's teats? The cow is in milk.

The Live-stock Division :—

A mild application recommended for the suppression of warts forming on a cow's teats is a dressing of castor-oil after each milking. If the warts continue to increase in size it is advisable to use some caustic agent such as silver nitrate, applied carefully after each milking. When a number of warts are present, however, it is more convenient to wait until the cow has been dried off, when the warts may be snipped off with a pair of surgical scissors, the surface being lightly touched with the caustic or painted with tincture of iodine.

NOTE.—"Pioneer," who inquires regarding grass mixtures, &c., has omitted to give his name and address. These are required.

EXPORTS OF NEW ZEALAND PRODUCE FOR YEAR ENDED 30TH JUNE, 1928.

Item.	Unit.	Quantity.	Value.
			£
Butter	Cwt.	1,467,954	11,315,756
Casein	,,	44,372	141,430
Cheese	,,	1,529,872	6,360,766
Fish	,,	24,702	85,562
Beef, frozen	,,	692,231	977,623
Lamb, frozen	,,	1,865,784	6,669,196
Mutton, frozen	,,	1,095,937	2,085,607
Beef, salted	,,	4,990	10,685
Meats, potted and preserved	,,	68,316	237,306
Sausage-skins	Lb.	3,715,870	766,345
Milk, preserved	,,	1,091,497	27,513
Milk, dried	,,	12,414,035	318,964
Beans and peas	Centals	208,227	180,559
Oats	,,	260,739	111,155
Apples, fresh	Lb.	39,651,282	496,870
Hops	,,	406,350	22,612
Potatoes	Tons	951	7,755
Live-stock	..	..	114,224
Calf-skins	Number	750,408	245,947
Hides, horse and cattle	,,	451,476	903,834
Rabbit-skins	,,	12,333,438	633,090
Opossum-skins	,,	133,344	77,587
Sheep-skins, with wool	,,	1,371,790	488,206
Sheep-skins, without wool	,,	8,626,621	1,296,428
Wool	Bales	667,225	10,548,869
Phorium-fibre	Tons	13,921	391,759
Seeds, grass and clover	Cwt.	75,827	291,161
Tallow	Tons	29,510	882,297
Coal	,,	120,688	172,468
Kauri-gum	,,	4,588	245,834
Gold	Ounces	125,855	518,468
Silver	,,	437,009	43,711
Leather	..	..	20,787
Timber, sawn	Sup. ft.	35,389,421	308,474
Other New Zealand produce	..	..	1,095,697
Total Value	..	..	54,184,545
Total for Year ended 30/6/27	..	..	45,457,491

In addition to New Zealand produce, re-exports from the Dominion in 1927–28 amounted to £1,434,740, and in 1926 27 to £937,591.

Pig Industry Investigations.—At the July meeting of the Research Council the Chairman reported on this subject as follows: "The establishment of three pig-recording investigations at Lincoln College, Massey College, and in the Waikato, has met with a very good response. In all instances no difficulty has been experienced in securing the ready co-operation of farmers in the scheme, and the recording officers will be fully occupied in weighing regularly the large number of pigs which have been offered for the test. The large amount of information which will be gathered by this means should prove of very great use in the direction not only by guiding farmers in the economical use of pig-feeding materials but also assisting in the breeding and selection of the most desirable strains of pigs for local and overseas markets."

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MINERAL CONTENT OF PASTURES.

LIME-DEFICIENT AREAS AND A HITHERTO UNSUSPECTED MALNUTRITION DISEASE IN SHEEP.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

A TYPE of air-borne volcanic soil differing greatly in response to fertilizers and in agricultural value from the coarser pumiceous sandy and sandy-silt soils of the central district of the North Island is the volcanic loam of what is known as the King-country. This loam has been derived by weathering from showers of fine volcanic dust or mud, and is described by Henderson and Ongley (Bull. Geological Survey No. 24, p. 56). The analytical examination of this type of soil and of the pasture growing upon it has been the subject of recent investigation. In August, 1926, the writer was first consulted regarding a loam soil which, with its subsoil, showed a very characteristic section in the road-cuttings — a brown loamy face which cracks up in summer, then appearing as a much-fissured surface exactly similar to that described by Henderson and Ongley.

This type is abundantly distributed in the Mairoa Riding of Waitomo County, about fifteen miles west of Te Kuiti, at an elevation of about 1,000 ft. above sea-level. The local rainfall is a heavy and well-distributed one; the surface features show what the farmer would call "easy country," and the native vegetation originally consisted of forest and shrubs of a type that might be called mixed rimu-tawa forest, which indicates good soil rather than bad. On many farms the forest had been burnt off over twenty years previously, and, generally speaking, the whole area consisted of surface-sown pasture, a great deal of which had reverted to fern and second growth. Where the pasture was still maintained it had reverted from the ordinary grasses sown on the burn, including rye-grass, cocksfoot, and clovers, to danthonia, Yorkshire fog, and brown-top. The complaint one had to investigate was not so much the fact of decreased carrying-capacity of pastures which had for their first seven or eight years after the burn carried one and a half ewes to the acre, and now only carried less than one dry sheep, but that even with that diminished stocking the animals did not thrive, and the number of culls in the flock greatly diminished or altogether extinguished the profit. There was very little cultivation

practised, and club-root (finger-and-toe) disease in cruciferous crops grown in field or garden was alleged to be an invariable occurrence.

Nine soils and subsoils (W 506–514) from Mairoa were examined in September, 1926, and showed that the "lime-requirement" by Hutchinson and McLellan's method ranged from 0·8 to 1·22 per cent. calcium carbonate, which means that to fully satisfy this requirement would take about 10 tons of crushed limestone per acre. There was one exception. This country, it should be mentioned, is characterized by the outcropping on the hills and many of the gullies of a pure, hard, white limestone, often standing out in picturesque pillar-like masses. If a sample of soil or pasture was taken near the influence of these limestone outcrops, in the one case the lime-requirement was lowered to a figure something like that of the average acid soils of the North Island, and in the other case (the pasture) the calcium content was found to be from two to three times as great as a sample gathered from soil away from the limestone influence. These lime-requirement tests were done on both soil which had had no top-dressing and on soil which had been heavily top-dressed with superphosphate and potash, and it was evident that the top-dressing had not appreciably altered the "lime-requirement" figure. Moreover, the soil taken near the limestone contained from two to three times the quantity of calcium extracted by hydrochloric and citric acid as that sample taken away from the influence of limestone, and the soil acidity was found to be much higher in the latter than in the former case.

The worst soils for "dopiness," as the local farmers call the deficiency disease, are those of settlers who will be termed here "Farmer O'M.," "Farmer MacC.," and "Farmer N.," while "Farmer T.'s" land is generally recognized as superior. The samples of soil drawn near the limestone outcrops (separated by lines from the others in the following table) are outstanding in their composition compared with the soil away from the influence of limestone.

Table 1.—Correlation of Sourness with Lime Content and Requirement in Mairoa Soils.

Location of Soil.	Calcium Oxide (Lime) extracted by		Lime-requirement Figure.	pH Figure.*
	Citric Acid.	Hydrochloric Acid.		
Farmer O'M.:				
No. 1 pasture	0·15	0·59	1·20	5·2
Virgin forest	0·23	0·74	0·89	5·8
Northern paddock	0·15	0·57	0·99	5·3
No. 2 paddock	0·13	0·65	1·01	5·3
Near limestone	0·57	1·63	0·38	6·3
Farmer McC.	0·12	0·53	0·67	5·0
Farmer N.	0·19	0·84	0·75	5·4
Farmer N. (Ngapenga No. 2) ..	0·20	0·81	0·95	5·4
Farmer T. (good soil)	0·39	1·00	0·56	6·1

* The values given under "pH Figure" indicate the relative degree of soil acidity. pH 7·0 = neutrality; higher figures indicate increasing alkalinity, and lower figures increasing acidity as the figures diminish.

It is satisfactory to obtain confirmation of one's analytical results by means of figures derived from another analyst's work done in another laboratory. A well-known agricultural chemist has examined a similar but better soil at Aria (a neighbouring locality), and finds " a very high lime-requirement " of land grassed twenty years, and recommends " 2 tons of ground limestone per acre," and to experiment with mineral supplement feeding for stock. Another agricultural chemist, working in a third laboratory, also obtained a lime-requirement figure for a Mairoa soil similar to that found in the Agriculture Department's laboratory.

The next step was to analyse the soils fully, both for chemical and mechanical analysis. The mechanical analysis of a composite sample of Mairoa soil (W 609) showed that it was a loam soil containing in percentages on the air-dried soil of the fine earth passing a 2 millimetre sieve: 0·5 fine gravel, 9·4 coarse sand, 15·0 fine sand, 14·1 silt, 12·3 fine silt, 15·1 clay, 8·3 moisture, and 27·6 loss on ignition.

The same composite sample (W 609), containing samples mostly from top-dressed land, showed on chemical analysis (Table 2) high amounts of mineral plant-foods, both available and total, usually supplied in artificial fertilizers. The loss on ignition was high, and the total nitrogen was very high. The analysis, therefore, showed that the soil was not deficient in the usual plant-foods it is necessary to supply in fertilizers—nitrogen, potash, and phosphates to such an extent that the health of the stock could be affected.

Other soils were analysed from lands which had not been top-dressed, and, although the available phosphate was, as might be expected, lower, it was still present in amounts relatively high for a hill soil. The outstanding feature in the analyses was the high lime-requirement in every case, except those samples taken from near limestone outcrops and from farms known to be of better quality as regards feeding-capacity and health of stock. Therefore, it did not appear that there was any deficiency, whether of phosphates or potash, which could account for the failure of the stock to develop in a normal manner. The writer visited the district in November, 1926, and could find no dearth of feed such as would account for the ill-nourished condition of the sheep. The most extraordinary statement received was that although a top-dressing of phosphates increased the carrying-capacity of the land in summer, it did not decrease the long tail of culls sufficiently to enable sheep to be profitably farmed, and that in the colder months of the year the pastures, whether top-dressed or not, were full of moss.

The Turakina and Himatangi soils shown in the table are two fertile Wellington west coast soils of very different types—one a silty loam, the other a dune-sand. Dairy-farming is successfully carried out on both types, the analyses being inserted for comparison with those of the Mairoa soils.

The writer reported regarding the Mairoa lands in December, 1926: " From what I could see and ascertain from laboratory tests it seems that lime is required to improve the composition and texture of the soil, the lime-absorption of most of the soils being about 1 per cent., which, translated into terms of tons per acre, would, roughly speaking,

amount to about 10 tons per acre of carbonate of lime. This is, of course, an empirical laboratory test, and by no means to be taken as indicating that it would be profitable to apply such a large amount. It is extremely desirable that further investigations should be made into the best method of reclaiming this fine country, which is rapidly going back to fern. It seems quite probable that some form of calcium, which is alkaline, may prove a very strong agent in bringing this land back to its previous productive capacity."

The writer, with the idea that there was a deficiency disease, visited the district again early in 1927, and again later in the year, with Mr. J. Lyons, Director of the Live-stock Division. Under his direction post-mortems of some ill-nourished sheep were made, and the idea that parasites could be the cause of the trouble was eliminated. The hypothesis was then adopted that a deficiency disease was the cause of the failure of sheep to develop normally. It was reported by one farmer that a few sheep which had been diagnosed as suffering from deficiency disease in September, 1927, were placed on a limed paddock, where they made a quick recovery, and were sold fat a few months later. The great dearth of Leguminosæ in these pastures was brought home to one by the fact that a skilled assistant sent to take a sample of clover (red and white) on an 800-acre farm in April, 1927, returned with the report that not enough could be found to analyse!

The fact that the land had given good results for the years immediately succeeding the primary forest burn indicates that some element supplied as a result of the burn had been slowly removed from the soil by leaching out in the drainage-water of the copious rainfall. Rothamsted results show that potash and phosphates are not leached out of clay soil, but that calcium, nitrates, sulphates, and chlorides are lost in considerable quantities by leaching. Sulphur and chlorine cannot be the deficient elements in the Mairoa land, as they have been supplied freely in superphosphate and potash salts without effecting the required improvement in the stock. Nitrogen is present in large amounts as total nitrogen, so that it cannot be this element. The only element that answers all criticism is calcium, which would be supplied, it is calculated, by a forest burn in amount equal from ½ ton to 1 ton of calcium carbonate per acre. Calcium in one form or another is the largest constituent of wood-ashes; it is certainly a necessary element to success in farming these loam soils of high organic-matter content, and it would be comparatively quickly removed by leaching.

Deficiency of lime in the soil leads to deficiency of Leguminosæ in the pasture. These Leguminosæ—clovers, lotus, trefoils, medicks, and melilots—normally contain much greater amounts of lime and phosphates than do grasses, and hence a pasture containing legumes is highly desirable for sheep-farming, since a high calcium content in the pasture is much more necessary for sheep than for cattle. Deficient calcium in the pasture leads to all kinds of diseases in stock. It also probably injuriously affects the growth of bone in the animal; and it may be noted that many Mairoa sheep which have died have exhibited extraordinarily weak bones. Calcium is the chief constituent in bone ash. Dr. McIntosh states: "A ration deficient in calcium may result in phosphate starvation even when sufficient amounts are present in the food. These two elements are very closely associated in their relation to physiological and structural functions in the body."

Table 2.—Chemical Analyses of Mairoa and other Soils.

Results, except *, are percentages on soil dried at 100° C.

Sample No.	Locality.	Volatile Matter.			Total Nitrogen.	1 per Cent. Citric-acid Extract: Dyer's Method, Hall's Modification ("Available Plant-food").				Hydrochloric-acid Extract ("Total Plant-food").				Lime-requirement (per Cent. $CaCO_3$).		pH Value.
		* On Air-drying.	* At 100° C.	On Ignition.		Lime (CaO).	Magnesia (MgO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Potash (K_2O).	Phosphoric Acid (P_2O_5).	On Air-dried Soil.	On Soil dried at 100° C.	
	Mairoa Soils.															
X 557	Topsoil, unmanured, virgin (forest) ..	..	10·3	30·1	0·830	0·228	0·041	0·032	0·008	0·74	0·38	0·14	0·03	0·80	0·89	5·8
	Unmanured soil, average of samples X 555, 559, 561, 565, 569, 573, 575	..	9·3	26·6	0·607	0·161	0·035	0·025	0·008	0·69	0·39	0·17	0·02	0·82	0·90	5·3
X 563	Taken near limestone outcrops ..	..	9·8	20·4	0·599	0·573	0·087	0·033	0·007	1·63	0·92	0·34	0·15	0·34	0·38	6·3
X 609	Composite of manured soils	..	8·3	30·1	0·720	0·203	0·041	0·034	0·018	0·51	0·51	0·34	0·08	..	..	..
	Other Soils.															
W 1377	Turakina Valley	..	3·0	11·1	0·369	0·290	0·112	0·021	0·017	1·79	1·13	0·86	0·07	0·13	0·13	..
W 1379	Himatangi	..	0·7	3·1	0·075	1·155	0·052	0·016	0·003	3·41	0·69	0·35	0·01	†	†	..

† Carbonate of lime present.

[*Analyses by F. J. A. Brogan.*

Table 3.—Chemical Analyses of Mairoa Locality Pastures.

The results are expressed as percentages of the sample dried to constant weight in water oven. Analysis performed on the ash for minerals. The insoluble silica, sand and silt was fused with carbonate of soda and the total silica determined.

Sample No.	Locality.	Date collected.	Ash.	Sand + Silica (SiO_2).	Silica (SiO_2).	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Manganese Oxide (Mn_3O_4).	Sulphuric Anhydride (SO_3).	Total Nitrogen (N).	Manurial Treatment.	Remarks.
6006	Mairoa	10/4/27	12·18	2·13	1·97	1·13	1·20	0·61	0·028	0·92	4·20	6 cwt. super, 6 cwt. potash. No lime	Horse-paddock.
6007	Mairoa	10/4/27	12·01	1·74	1·04	1·12	1·23	0·60	0·029	1·06	4·36	1 ton lime carbonate, 4 cwt. potash, 2 cwt. super	Ram-paddock.
6018	Otanake	—/9/27	12·09	4·80	..	0·72	0·85	..	0·013	..	3·31	..	Roadside.
6019	Horepupu Road ..	—/9/27	12·24	3·68	3·47	0·87	1·08	..	0·026	..	3·08	..	Limestone outcrop near school.
6020	Otanake	—/9/27	10·44	3·12	2·90	0·70	0·59	..	0·057	..	3·37	..	Paddock No. 1, south side shelter-bush.
6021	Otanake	—/9/27	10·92	2·19	2·11	0·77	0·66	..	0·047	..	3·47	..	Paddock No. 2; away from limestone outcrop.
6022	Otanake	—/9/27	10·86	1·91	1·82	0·69	0·86	..	0·018	..	4·18	..	Pasture round limestone.
6023	Maungamangero ..	—/9/27	11·90	2·24	2·04	0·86	1·26	..	0·012	..	3·59	..	Around limestone.
6024	Maungamangero ..	—/9/27	10·82	1·49	1·35	0·83	0·79	..	0·028	..	3·76	..	Away from limestone.
6025	Waitungaruru ..	—/9/27	12·36	2·50	2·15	0·98	1·40	..	0·026	..	3·53	..	Grass round limestone outcrop.
8000	Mairoa	10/4/27	11·59	3·66	3·44	0·66	0·83	0·51	0·037	0·82	2·54	Unmanured, 21 years old	Yorkshire fog, Chewings fescue, danthonia, catsear, capeweed, piripiri, plantain, &c.

[*Analyses by B. C. Aston and I. Cunningham.*

A growing hogget requires 0·0093 lb. of calcium oxide a day (Wilson), and 100 lb. dry matter of the worst Mairoa pasture in summer contains, say, 0·7 lb. calcium. A hogget, even at its maximum capacity, would eat not more than 3 lb. of dry matter a day, or, say, 0·021 lb. calcium oxide, but at its minimum capacity probably not more than one-half to two-thirds of this. When it is remembered that, of the mineral food ingested, only one-third to one-half is capable of being digested, it will be seen that there is no margin to work on. In addition, in winter the calcium content is probably considerably lowered. The case of the milking-ewe in her demand for calcium is far worse than that of the hogget, for she requires 0·020 lb. calcium oxide daily, and if her ingested food contains about 0·021 lb. calcium oxide there is no margin to allow for calcium not digestible, or for the lowered content of calcium in the pasture due to seasonal change. Wilson also states: "In general, lime is the critical mineral, if not the critical food ingredient for sheep. . . . In poor pastures—*i.e.*, pastures containing no clovers—sheep are very short of lime."

It is not intended to overload this article with technical analysis either of soils or of pastures, but the writer will be glad to supply fuller information to any inquirer. The results show that where the pasture is limed or manured the calcium-oxide (lime) content is about twice as much as on the untreated pasture, whereas the disparity in the phosphate is not nearly so great. There is, however, very great difficulty in obtaining samples of what the sheep are actually eating, so that practical experiments in the field provide the only method of obtaining convincing results.

There is good evidence that sheep will improve on limed land in greater degree than on land which has been merely treated with phosphates; also that they prefer the herbage growing on the limed land, and that a lime dressing alone effects a very great improvement in poor and deteriorated pasture, inducing a growth of white clover which could not be detected on unlimed adjacent land.

The fact that the lime-requirement figure shows an absorption of calcium carbonate approximately equal to 10 tons per acre of ground limestone has been advanced as a reason for abandoning the Mairoa lands, since no one could afford to apply this quantity of lime. It is not, however, necessary to satisfy the high lime-requirement of 10 tons per acre; in fact, the full lime-requirement never is satisfied, even when it is, as in the majority of North Island soils, only in the vicinity of 2 to 4 tons per acre.

There are several methods which might be tried with the object of avoiding the great expense of liming, under the present conditions, large tracts of hill country. These fall under different headings:—

(1) Cheapening of lime—(*a*) By having local grinding plants for reducing limestone to powder; (*b*) by having local kilns for "burning" limestone; (*c*) by broadening the scope of the existing Government subsidy on the transport of lime.

(2) Feeding pellets or licks containing calcium in some available form.

(3) Bringing up the calcium content of the pasture on one paddock on each farm, and running the entire stock periodically on that particular paddock.

(4) Using deep-rooted legumes, such as lucerne, which if they could be established would provide a fodder with a high lime content.

SUMMARIZED INDICATIONS OF LIME-DEFICIENCY.

A number of field experiments are being carried out under the charge of the country analyst (Mr. C. M. Wright), attached to the Mineral Content of Pastures Investigation, to determine various points connected with these deteriorated lands. For the present it may be said that the following points all indicate that lime in some form is urgently needed for the loam soils similar to those analysed on which sheep refuse to develop normally :—

(1) Excessively high lime-requirement, and other laboratory tests denoting soil acidity.

(2) Non-success with phosphates and potash salts in eliminating the malnutrition which often shows itself in bone-weakness.

(3) Presence of club-root disease in cruciferous crops (which is checked by liming the land).

(4) Presence of sufficient available phosphate in the soil shown by chemical analysis.

(5) Excessive moss in the pasture, especially in the winter.

(6) Good results obtained by local farmers with wood-ashes, and the good results from the pastures established for the first eight years after a burn.

(7) Absence of clovers and other legumes in the pastures in spite of abundance of potash in the soil.

(8) Presence and great activity of worms on the limed compared with the unlimed pasture.

(9) Weakness of the bones of dead animals.

(10) Difference in the chemical analysis of the soils of fertile farms as compared with those of the deteriorated lands in the same district.

(11) Botanical composition of the unlimed pastures, which show much moss, Yorkshire fog, brown-top, danthonia, and species which love sour soils.

(12) Difference in the chemical analysis of the pasture on limed land compared with that on unlimed land.

(13) Preference of sheep specially, and stock generally, for limed pasture over unlimed pasture, even when liberally phosphated ; and the improvement in the health of sheep when transferred to limed pasture.

(14) High organic-matter content of all the soils analysed.

Export of Stud Stock.—Exportations of stud stock from New Zealand during the year ended 31st March, 1928, comprised 6,287 sheep, 184 cattle, and 13 draught horses. In addition a number of thoroughbred and trotting horses were shipped to Australia, mainly for racing purposes.

POTATO-CULTURE.

DESCRIPTIONS OF SOME OF THE MORE IMPORTANT VARIETIES.

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THE descriptions of potatoes here given are those of varieties most commonly grown in New Zealand, most of which are eligible for inspection under the Government certification of seed-potatoes system. The descriptions are intended to be used in the hands of potato-growers, merchants, and seedsmen, and have been kept as simple as possible, although it must be confessed that this virtue may have resulted in some of the descriptions being rather indefinite. It is almost certain that there are some minor inaccuracies, which will be corrected as more investigation work is carried out. There exists, however, so much confusion, and the need for some definite system of nomenclature is so urgent (more especially in view of the introduction of certification) that the writer feels there is full justification for the publication of such information as is available at the present time. The effort will not have been in vain if it stimulates growers and merchants to take an active interest in the attempt now being made to create order out of the present disorder, and this can be accomplished only if those interested will assist.

The writer would welcome any criticism or information which may assist in correctly "placing" each variety of commercial importance. In fact, this matter is published as much with a view to collecting as of imparting information.

Scheme of Varietal Descriptions.

In describing varieties it is necessary to use certain terms, which must be understood clearly before the reader can make full use of the descriptions. The writer has made free use of information available from works by Salaman*, McIntosh†, Stuart‡, and the various publications issued by the Board of Agriculture for Scotland.

The following terms are used in the descriptions :—

HABIT.

"Habit" refers to the general appearance of the growing plant. It is the mental picture which is of such great value in identification and yet so difficult to describe.

(*a*) *Height* when grown under normal conditions : Tall, 2 ft. or over ; medium, 18 in. to 2 ft. ; short, below 18 in.

(*b*) *Type of growth* may be "upright" or "spreading."

(*c*) *Vigour* may be described as "strong," "medium," or "poor."

(*d*) *Open or compact growth :* "Open" when the stems can be seen distinctly through the leaves ; "compact" when the foliage is so dense that the stems are not easily observed.

* "Potato Varieties," R. N. Salaman, M.D., Cambridge University Press.
† "The Potato," Thomas P. McIntosh, B.Sc., Board of Agriculture, Scotland.
‡ "The Potato," William Stuart, U.S.A. Department of Agriculture.

STEM.

(*a*) *Wings* may be waved or straight. The wings are easily observed, running the length of the stem, and assist to exaggerate the characteristically triangular shape of the cross-section of the stem. The observations should be limited to the upper two or three internodes of the stem.

(*b*) *Colour.*—It is very rarely that a stem is totally devoid of colour, and the amount present, although liable to modification according to the amount of light, is a valuable aid in identification. The writer has for some years used the figures 1 to 10 as an index to coloration, but, since discovering that Dr. Salaman uses the figures 1 to 4, has adopted this method in the descriptions which follow. Colour 1 would indicate slight coloration, more especially about the ground-level. In Colour 4 the concentration would be so great as to make the stem a deep red-purple. This degree of coloration is very rare, and would almost certainly extend to the midrib of the leaf and leaflets and the flower-stalk.

LEAF.

The potato has a compound leaf consisting of a number of leaflets. Certain variations are exhibited which afford valuable aids to identification. The colour, for example, is described as light, medium, or dark green, although the presence of mosaic may very materially affect this characteristic.

INFLORESCENCE.

(*a*) *The trusses* of flowers may be prominent or inconspicuous, depending upon the length of the flower-stalk. (*b*) *The flowers* themselves may be numerous, scanty, or rare. (*c*) *Flower-colour* is an important varietal characteristic, but one that is modified by hot weather or intense sunlight, and should be taken from a freshly opened flower. Flowers may be white or coloured. Coloured flowers are here described as being red-heliotrope, blue-heliotrope, and pure blue.

TUBER CHARACTERISTICS.

Where potatoes are bought and sold without any field inspections the tuber affords the only means of identification. Its value for this purpose is greatly exaggerated by merchants, seedsmen, and growers, for the tuber is subject to considerably more modification from environment than any other part of the plant. Moreover, the differences, which may be very apparent to one who has handled potatoes for many years, are often difficult if not impossible to describe.

(*a*) *Skin.*—This may be described as smooth (Fig. 8), rough (Fig. 1), russet (Fig. 14), or scaled (Fig. 13).

(*b*) *Colour.*—White potatoes offer a wide variation of shades, depending largely upon the thickness of cork layers of the skin. Bresee's Prolific, although classed as white, is in reality a very pale pink or flesh colour. This can be best observed on an immature tuber, and is intensified on exposure to light, which is also the case with Epicure. Coloured potatoes may be self-coloured or the colour may be unevenly distributed. The distribution of the pigment may be around the eyes, as in King Edward, or it may spread over the intervening spaces, leaving the skin

around the eye without colour, as in Pink Beauty of Hebron. The colours are here described as white, pink (pale red), red, light purple, and deep purple.

(*c*) *Shape.*—It is extremely difficult to describe shape correctly. The characteristic is modified by soil and rainfall, and in a dry soil the tuber will tend to be shorter than normal. A tuber has a rose end and a heel end, the latter being that end nearest the point of attachment to the parent plant. On holding a tuber with the rose end down there will be seen a distinct brow surmounting the eye. In most tubers there is a distinct upper and lower surface. The upper surface is often rounded and carries most of the eyes, the lower surface is often flat, or even concave. On placing a tuber flat side down the lateral contour can be observed. Classification according to shape offers considerable difficulties. In these notes the apparent shape is described as round, long, kidney, or oval.*

Round: Such tubers are as long as they are broad in contour, but may be more or less flattened (Fig. 12). There is nearly always a depression at the heel end (Fig. 10).

Long: Potatoes of this type may be either finger-shaped or cylindrical. In cross-section they are round. The finger-shaped is tapering and often hooked at the heel end, as in Black Kidney. The cylindrical type is of more or less equal diameter throughout its length—that is, the sides are parallel (Fig. 3).

Kidney: The kidney is described as long with elliptical ends (Fig. 17). It does not necessarily have any lateral depression such as the name would suggest, and as is depicted in Fig. 23.

Oval: This merely describes a short kidney (Fig. 13).

Flesh Colour.—This is described here as white, intermediate, or yellow. Salaman has shown that genetically there are two types—the yellow (as in Leader) and white (as in Dakota). The intermediates are heterozygous, resulting from white × yellow. In addition, the flesh may contain the pigment present in the skin, but in commercial varieties this is confined to the vascular tissue.

Eyes.—(*a*) These may be deep (Fig. 1), medium (Fig. 5), or shallow (Fig. 13). (*b*) They may be evenly distributed (Fig. 2) or mainly at the rose end (Fig. 14A). (*c*) The colour of the eyes and the skin surrounding the eye is a valuable aid in identification, and is most easily observed in the immature tuber. Northern Star has a characteristic "picked eye," the colour being much deeper than that in Bresee's Prolific.

Sprouts.—A great deal of importance is attached to the sprout as a means of identifying rogues, and it is equally valuable as a means of identifying degenerate tubers. In these notes the sprouts are described as pink, deep pink, and blue.

MATURITY.

The terms used in this connection are "first early," "second early," "early main crop," and "late main crop."

* It is of interest to note in this connection that Dr. Salaman has demonstrated the existence of only three genetic types—the round, the kidney, and the long. Of these, the kidney (which includes the ovals) is the heterozygous or hybrid form resulting from long × round. He points out that true rounds are uncommon in commerce, and has proved that some varieties which appear to be round are not in reality so, for on "selfing" they break up, giving rise to the Mendelian ratio of 3 long to 1 round.

SUMMARY.

Each variety has been dealt with on the following plan :—

Origin : Raiser's name, and parentage of variety.

Habit : Vigour—Strong, moderate, weak.
Height—Tall, medium, short.
Foliage—Open, medium, dense.
Growth—Upright, spreading.

Stem : Wings—Waved, straight.
Colour—1–4.

Leaf : Colour—Dark, medium, light green.

Inflorescence : Tall and prominent, medium height, short and inconspicuous.
Flowers—Numerous, scanty, rare.
Colour—White, red-purple, blue-purple, blue.

Tuber : Shape—Long (spindle or curved), kidney, oval, round, flattened, tapering (pear-shape).
Colour—White, pink (pale red), red, light purple, deep purple. Self-coloured, splashed.
Skin—Smooth, rough, russet, scaled.
Flesh colour—Yellow, intermediate, white, pigmented.
Eyes—Deep, medium, shallow. Distributed evenly or mainly at rose end. Eyes picked.
Sprouts—Pink, deep pink (pink and carmine), blue.

Maturity : First early, second early, early main crop, late main crop.

Classification of the Hebron Group.

If an attempt were made to group varieties there would be a degree of similarity in type between Dakota, Early Rose, Pink Beauty of Hebron, New Zealand White Beauty of Hebron, Early Puritan, Endurance, and, finally, White Elephant. The correct nomenclature of the varieties here grouped together will entail some years of investigation. Such information as is available is given with a full appreciation of the fact that it may be liable to correction when more light is thrown on to the subject. The position is very complicated, not only through mis-naming but because some of these varieties have during the last fifty or sixty years thrown a number of sports, bolters, and wildings. In this country there appear to be the following recognized varieties of the group :—

Dakota.—This variety stands out as being quite distinct, although within the variety there seems to be considerable variation in foliage, which is possibly due to virus disease. The large proportion of Early Rose and Beauty of Hebron rogues present in commercial crops is sufficient indication of the similarity of these varieties.

Early Rose may be considered distinct, and is discussed under its type description.

Beauty of Hebron (Pink) is probably what is referred to in American writings as "Beauty of Hebron," and is described fully elsewhere. Stuart describes four variations of Beauty of Hebron.

White Beauty of Hebron as grown in this country does not appear to be true American White Beauty of Hebron, but rather than change a name in common usage the local variety will be referred to as New Zealand White Beauty of Hebron. The true White Beauty of Hebron is synonymous with Early Puritan, the skin of which is quite white. The skin of New Zealand Beauty of Hebron is creamy-white splashed with pink, and appears identical with the American White Elephant and Late Beauty of Hebron.

Early Puritan is identical with the true American White Beauty of Hebron, and will be referred to always as Early Puritan.

Endurance.—No record can be found of a variety of this name outside New Zealand. Its similarity to the other members of the Hebron group would suggest that it may be an American variety introduced and renamed.

White Elephant.—The tubers of this variety are very similar to Endurance except that they are larger and coarser. The foliage is that of the Hebron group, but the coloration on the heel end and in the sprouts is purple and the flowers blue. The variety is apparently quite distinct from the American White Elephant and Late Beauty of Hebron, and will therefore be referred to as New Zealand White Elephant.

Gold Coin is quite distinct, but is included in this group on account of tuber resemblance. Stuart places Gold Coin in the Green Mountain class, and the Scottish Board of Agriculture records it as being of the Up-to-Date class.

Finally, there is a rogue common in Dakota, Early Rose, and Beauty of Hebron, the tubers of which are flat and oval, eyes shallow, and skin smooth and of a deeper pink than Early Rose. Its most striking characteristics is the low-spreading haulm giving the appearance of a flat top, broad pale-green leaflets, and total absence of flowers. It is much earlier than any of the foregoing varieties of the group, and appears to tally with the American variety Early Ohio.

DAKOTA.

Origin.—Produced in America in 1883.

Habit.—Tall, vigorous, moderately open growth.

Stems.—Wings waved. Colour 2, extending to flower-stalk and leaf-midrib.

Leaves.—Medium green.

Inflorescence.—Tall and prominent; flower-stalk coloured. Flowers white, moderately numerous.

Tuber.—Oval, flattened, tapering to rose end and deeply notched at heel end. Flesh pure-white, crisp, with sometimes a little colouring near rose end, especially in immature tubers. Eyes very deep and evenly distributed. Skin rough and red in colour. Sprouts deep pink.

Maturity.—Late main crop.

NOTES.—Probably the most valuable red potato grown in this country, on account of its excellent keeping and cooking qualities, and its ability to crop well on the warm light land of mid-Canterbury. Popularity has waned owing to the stocks being impure and containing a proportion of yellow-fleshed Leader (Fig. 4) and other varieties. It still commands a premium to growers of 15–20 per cent. above the price of other varieties grown in Canterbury.

FIG. 1. DAKOTA.

EARLY ROSE.

Origin.—A seedling of Garnet Chili, raised in America in 1861, and introduced into commerce in 1867.

Habit.—Medium vigour and height. Moderately dense and spreading.

Stem.—Wings moderately waved. Colour 1.

Leaf.—Medium to dark green.

Inflorescence.—Tall and prominent. Flowers white and numerous, more profuse than Beauty of Hebron.

Tuber.—Long spindle-shaped; often flattened and notched at heel end. Skin pink, moderately smooth; that at the rose end often a deeper pink and rough or netted. Eyes moderately deep and evenly distributed. There is no variation in colour around the eyes as can be observed in a freshly dug Beauty of Hebron. Sprouts deeper pink than Beauty of Hebron, and may be described as rose-lilac. Flesh, white and pigmented red. (Compare with Beauty of Hebron.)

Maturity.—Second early.

NOTES.—Probably no pure crops available. This variety has played an important part in the history of potato improvement, and is regarded as the fountain-head of present-day varieties.

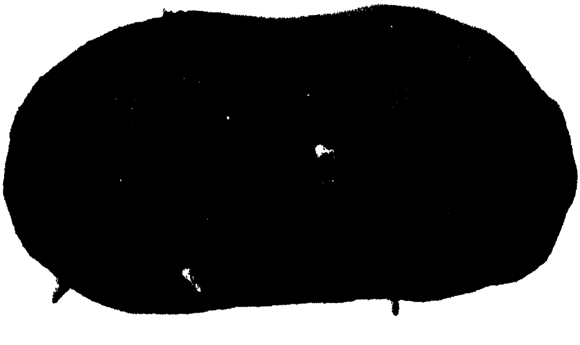


FIG. 2. EARLY ROSE.

BEAUTY OF HEBRON (PINK).

Origin.—Raised in America from a seedling of Garnet Chili in 1878, and introduced into commerce by Peter Henderson of New York.

Habit.—Medium vigour and height. Moderately dense and spreading.

Stem.—Wings moderately straight. Colour 1.

Leaf.—Medium to dark green.

Inflorescence.—Tall and prominent, and no colour in flower-stalk (compare with Dakota). Flowers, white and numerous.

Tuber.—Long spindle-shaped, often flattened and notched at heel end. Skin, pink and moderately smooth. The skin around the eyes of a freshly-dug tuber is creamy-white. Eyes moderately deep and evenly distributed. Sprouts pale pink. Flesh, white. (Compare with Early Rose.)

Maturity.—Second early.

NOTES.—This variety is extremely difficult to distinguish from Early Rose. Few if any pure crops are available, most lines being a mixture with Early Rose. It is a common impurity in the Dakota, from which it can be distinguished by its more prominent inflorescence and the green flower-stalks. A useful variety for the garden. The Southern commercial crops are mainly grown for the North Island seed trade. Very susceptible to late blight.

FIG. 3. BEAUTY OF HEBRON (PINK).

NEW ZEALAND WHITE BEAUTY OF HEBRON.

Origin.—This variety is distinct from the true American White Beauty of Hebron, and probably is identical with White Elephant or late Beauty of Hebron, in which case it originated from a cross between Garnet Chili and White Peachblow, and was introduced into commerce in America in 1881.

Habit.—Vigorous, tall, and open.

Stems.—Numerous side branches, wings waved. Colour 1.

Leaf.—Leaflets small and pale green.

Inflorescence.—Moderately prominent. Flowers white and not very numerous.

Tuber.—Long spindle-shaped, very variable, usually pointed at both ends. Skin creamy-white, splashed with variable amount of pink colouring which avoids the eyes; skin smooth. Eyes medium depth. Sprouts pink. Flesh, white and crisp.

Maturity.—Early main crop.

NOTES.—A satisfactory garden variety, but too brittle for market. Very liable to late blight. Wildings occur. There exists a great variation in shape and foliage due probably to the spread of wildings and the disease known as spindle tuber. There is even greater variation in colour, which ranges from almost pure creamy-white to the normal coloration of Pink Beauty. When reproduced from tubers these variants seem to retain the characteristic of the parent plant, and the possibility is that they represent a large number of mutants or sports arising during the last forty years.

EARLY PURITAN.

Origin.—Said to be a seedling of Beauty of Hebron, and introduced into commerce in America in 1888. It is synonymous with the true American White Beauty of Hebron, but not with the New Zealand White Beauty of Hebron (which see).

Habit.—Medium height and vigour; spreading and medium to dense foliage.

Stem.—Wings slightly waved. Colour 1.

Leaf.—Medium, green and glossy; secondary leaflets very small.

Inflorescence.—Prominent. Flowers white and fairly numerous.

Tuber.—Oval, pointed and often flat at heel end. Skin, white and smooth. Eyes medium to deep, with long and prominent eyebrows. Sprouts very pale pink. Flesh, white.

Maturity.—First early to second early.

NOTES.—Very subject to disease, particularly late blight. Excellent cooking and keeping quality, and at one time very popular. As a result other varieties are sold under this name, and very large areas of Bresee's Prolific are grown and sold as Early Puritans.

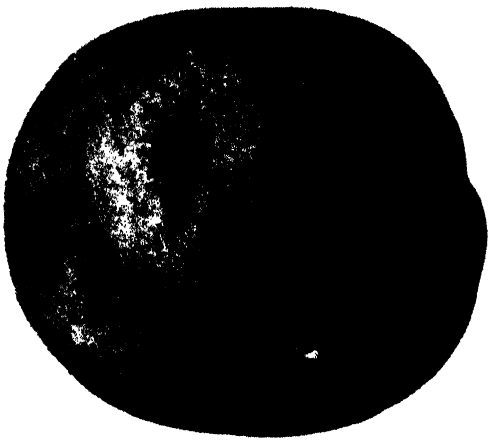


FIG. 4. LEADER, A YELLOW-FLESHED VARIETY FOUND AS AN IMPURITY IN MANY DAKOTA CROPS.

ENDURANCE.

Origin.—Not known. Probably an American variety renamed in this country.

Habit.—Of moderate vigour and height; upright and open.

Stem.—Wings distinctly waved. Colour 1.

Leaf.—Small, crinkled, and medium green.

Inflorescence.—Tall. Flowers white, occasional to numerous.

Tuber.—Large, and somewhat inclined to be misshapen. Oval to kidney (long oval), often flattened at heel end, and notched. Skin white, moderately smooth, sometimes flaked. Flesh white and crisp. Eyes medium to deep, and evenly distributed. Sprouts pink. Tubers similar in appearance to New Zealand White Elephant, except they are not so coarse and misshapen, and show no colour at heel end.

Maturity.—Early main crop.

NOTES.—A valuable variety for light land, though very liable to late blight. Flesh is so brittle when crop newly dug as to render variety not suitable for shipping. Cooking and keeping qualities excellent.

FIG. 5. ENDURANCE.

NEW ZEALAND WHITE ELEPHANT.

Origin.—Not known. Distinct from American White Elephant. (See New Zealand White Beauty of Hebron.)

Habit.—Tall, vigorous, upright, and open.

Stem.—Wings large and waved, and mottled purple. Colour 2, extending to midrib of leaf and flower-stalk. Much branched.

Leaf.—Pale green ; small leaflets.

Inflorescence.—Not prominent. Flowers blue, occasional, and fall early or before opening. Calyx tinged red-purple.

Tuber.—Oval, often flattened at heel end and notched. Shape irregular, and much second growth. Eyes very deep, and large bump above the eyes. Skin medium to smooth. Colour white, with tinge of purple on stolon and at heel end of tuber if examined when freshly dug. Sprouts blue. Flesh white. Tubers very similar in appearance to those of Endurance, except that they are coarser and more misshapen.

Maturity.—Late main crop.

NOTES.—Synonymous with Australian Snowflake. Crops heavily on moist rich land, but not popular, on account of the large, coarse. misshapen tubers. It is an excellent table potato, and keeps well if late blight is absent. It will not stand transport, being very brittle when freshly dug. This variety is much disliked in commerce, and is invariably rejected for the North Island trade by port graders acting under instructions from the merchants' associations.

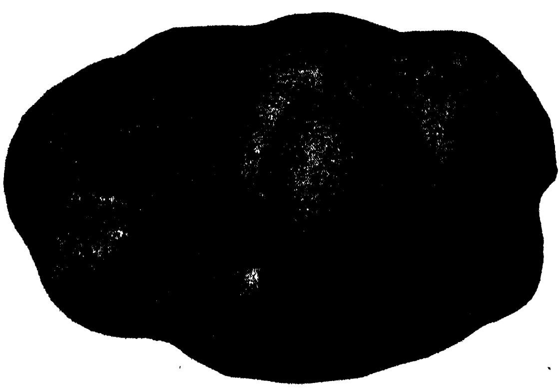


FIG. 6. NEW ZEALAND WHITE ELEPHANT.

GOLD COIN.

Origin.—American origin. Introduced into commerce about 1903.

Habit.—Medium vigour and height. Spreading, rigid, and open.

Stem.—Contains no colour.

Leaf.—Medium green; leaflets small.

Inflorescence.—Inconspicuous. Flowers white, very rare; buds green, mainly drop off. Flower-stalk green; stamens orange.

Tuber.—Large, long oval to kidney flattened. Skin light creamy-brown, smooth to rough. Flesh white. Eyes moderately deep. Sprouts creamy-white, no colour observed.

NOTES.—An excellent potato, requiring good land, but very susceptible to late blight.

FIG. 7. GOLD COIN.

(To be continued.)

CARELESS DIPPING OF SHEEP.

THE following remarks on this matter are made by the Director of the Live-stock Division, Mr. J. Lyons, M.R.C.V.S., in his annual report for 1927–28:—

From all parts of New Zealand reports have come to hand indicating that sheep are being dipped in a careless manner, and that the dips have not answered the purpose for which they were intended—namely, freeing from lice. Under such circumstances sheepowners invariably blame the dips as being ineffective. I am satisfied that in a large majority of cases it is not the dip that is at fault, but the manner in which it is mixed or dissolved. There are numbers of dips on the market that, when properly mixed with soft water in a bath that has been thoroughly cleaned, will do excellent work in freeing the sheep from lice and ticks. If sheepowners would see that this is done, fewer complaints would be made with reference to the ineffectiveness of dips. From the Canterbury districts reports were received that a considerable amount of mortality had been observed in a number of farms amongst sheep that had been recently dipped. Again the dipping-fluid was blamed. On investigation, however, it was found that it was the first mixing of the dip for the season in these cases, and the first sheep that were put through the dip were the ones to suffer. On post-mortem examination it was found that the sheep had died from inflammation of the lungs, and, in some instances, the stomach and intestines, thus clearly showing that the dip had not been thoroughly mixed, and that some of the poisonous material was floating on the top of the water and had been swallowed by the sheep. With such mixing, even if material is not swallowed, there is always a liability of the sheep becoming scalded. It is to the interest of all sheepowners to see that the dip is mixed satisfactorily.

OFFICIAL HERD-TESTING OF PUREBRED DAIRY COWS.

SURVEY OF THE FIRST SEASON'S WORK, 1927–28.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE Official Herd-test* has now completed its first year of operation, and an examination of the year's results reveals some interesting features. The support accorded the scheme has been gratifying, and sufficient to signify that it has met with the approval of the majority of our Certificate-of-Record testing breeders. All new ventures experience a share of adverse criticism, and constructive criticism is always appreciated. It is pleasing to be able to state that breeders as a whole have found very little fault with the O.H.T. rules, and that some have submitted suggestions of a helpful nature.

At the height of the 1927–28 season the number of cows on official herd-test was approximately 1,550. For summarizing purposes, however, it has been found necessary to consider the 31st July, 1928, as the close of the season, all cows which had completed their 305-day test at that date, or had been previously dried off or withdrawn, being included in the summary. Needless to say, however, some later-calving cows had not completed their testing-period at that date, and consequently are omitted from this survey.

From a summarizing point of view the official herd-testing presents much the same difficulties as the ordinary herd-testing, inasmuch as cows are withdrawn at varying stages of the lactation period of ten months permitted by the rules governing the test. C.O.R. cows are, of course, classified on the basis of certificates gained, but with the O.H.T. there are no requirements in this connection. A study of the year's results suggests that a classification on the basis of all cows on test six months—180 days or more—is perhaps most fairly representative of the position, and this demarcation has therefore been adopted as the principal basis for summarizing.

As persons interested in the O.H.T. are aware, the system is, broadly speaking, confined to registered purebred dairy cows. In one or two instances, however, and subject to special circumstances, the O.H.T. has been extended to the testing of a few cows other than registered purebreds. In the accompanying tables cows other than purebreds have been omitted. It may be stated for general information, however, that eighty-seven grade cows were included in the herds on which this summary is compiled.

Table 1, which is computed on the basis of all cows on test 180 days or more, and, as with all tables in this survey, is complete to 31st July, 1928, provides an indication of the general position regarding the number of O.H.T. cows tested during the season.

In connection with this table it may be mentioned that although the total number of cows tested appears as 1,127, there were 133 cows withdrawn or finished up prior to the 180 days, thus making a total

* Particulars of the O.H.T. were given in the *Journal* for July, 1927, under the heading of "The Official Herd-test: An Adjunct of the C.O.R. System."

of 1,260 cows. Had this table been based on cows on test 100 days or more the number would have been 1,207, indicating that 80 cows dropped out between 100 and 180 days. On the other hand, some 164 cows had not concluded their testing-period at 31st July and some 126 grades have also to be considered, so that the maximum number of cows on test in any one month during the year was, as previously stated, about 1,550.

Table 1.

Breed.	Number of Breeders.	Number of Cows.
Jersey	73	605
Friesian	20	376
Ayrshire	2	65
Milking Shorthorn	5	53
Red Poll	2	28
Totals	102	1,127

Table 2, which also includes all cows tested 180 days or more during the period under review, shows the average production for each breed, and for all cows combined.

This table is self-explanatory, but some interesting comparisons are provided by certain other figures which have been taken out. An average compiled on the 100-day basis, as used for ordinary dairy-herd testing, gives a result of 274·42 lb. butterfat in 259 days, which compares favourably with an average yield of 240·48 lb. in 236 days for all cows on herd-test in New Zealand in 1926–27. Then again, if the O.H.T. cows are summarized to include only those which milked seven months or more, it is found that the average yield is 290·23 lb. butterfat. While the O.H.T. average yield may not be as high as some have expected, the fact must not be lost sight of that the system has been made use of to try out untested cows rather than animals specially selected for the purpose of making high records. Moreover, the shortness of the average lactation period must also be borne in mind. The average C.O.R. cow in 1927 gave 469·56 lb. butterfat.

Table 2.

Breed.	Number of Cows.	Average Yield for Season.		
		Average Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Jersey	605	274	5,709·9	305·79
Friesian	376	263	7,526·8	264·29
Ayrshire	65	253	5,712·6	232·02
Milking Shorthorn	53	252	5,646·9	228·64
Red Poll	28	283	6,254·1	267·18
All cows	1,127	268	6,326·8	283·10

In Table 3 are given particulars of the highest and lowest individual herd yields within each breed. This table is also based on the 180-day minimum.

Table 3.

Breed.	Highest Herd.			Lowest Herd.		
	Number of Cows.	Average Days.	Average Butterfat.	Number of Cows.	Average Days.	Average Butterfat.
			lb.			lb.
Jersey	4	305	514·71	2	257	197·79
Friesian	16	290	361·33	38	220	192·65
Ayrshire	27	265	255·39	38	245	215·41
Milking Shorthorn ..	6	283	288·87	5	219	205·62
Red Poll	24	285	277·13	4	268	207·45

It will be observed that the margin between the highest and lowest average yields is in most instances considerable, but it will also be apparent that where the differences are most marked the actual average yield variation is largely accounted for by the difference in average days on test. It may be mentioned that the highest Friesian herd included is that of the Agriculture Department's Central Development Farm, at Weraroa. The highest Red Poll herd is also that of the same farm.

Table 4 summarizes the highest and lowest individual cow for each breed.

Table 4.

Breed.	Highest Cow.		Lowest Cow.	
	Days.	Butterfat.	Days.	Butterfat.
		lb.		lb.
Jersey	305	603·60	211	95·03
Friesian	305	560·53	194	106·94
Ayrshire	305	398·79	225	107·84
Milking Shorthorn	305	419·29	199	120·68
Red Poll	305	447·52	254	144·82

When the length of lactation period is taken into consideration it must be admitted that this table records some creditable yields. In fairness it should be stated that the lowest yields for the Friesian, Milking Shorthorn, and Ayrshire breeds were two-year-olds. Nevertheless, despite this fact, the yields show considerable room for improvement. It may also be mentioned that the leading cows for the Friesian and Red Poll breeds are from the Central Development Farm.

Table 5 provides a more detailed classification of production. In this tabulation the various breeds participating in the O.H.T. are subdivided according to age.

Table 5.

Class.	Number of Cows.	Average Days in Milk.	Average Yield for Season.	
			Milk.	Butterfat.
		Jersey.		
			lb.	lb.
Two-year-old and under ..	219	275	5,094·8	274·32
Three-year-old	117	273	5,914·5	322·34
Four-year-old	97	277	6,206·1	331·85
Mature	172	270	6,062·5	319·23
		Friesian.		
Two-year-old and under ..	121	257	6,005·1	213·78
Three-year-old	73	261	7,586·2	260·87
Four-year-old	58	272	8,363·2	292·79
Mature	124	268	8,609·7	302·24
		Ayrshire.		
Two-year-old and under ..	24	235	4,192·9	169·70
Three-year-old	15	258	6,061·5	234·57
Four-year-old	6	243	6,009·0	243·07
Mature	20	274	7,435·5	301·56
		Milking Shorthorn.		
Two-year-old and under ..	25	252	4,589·2	191·39
Three-year-old	6	255	6,890·2	280·86
Four-year-old	4	257	6,961·1	284·56
Mature	18	252	6,359·5	250·56
		Red Poll.		
Two-year-old and under ..	3	281	5,233·4	225·04
Three-year-old	8	280	5,372·3	230·51
Four-year-old	4	296	6,604·8	274·44
Mature	13	281	6,924·5	297·23

This table reveals features common to most classifications of the kind. For instance, the most heavily represented classes are the two-year-old and the mature. Then, again, the four-year-old class is in all cases a weak one numerically. It will be observed that with the majority of the breeds the production trend from the lowest-age class to the highest is a normal one, although the Jerseys and the Milking Shorthorns are exceptions. With each of the latter breeds the production for the average mature cow is lower than that for the average four-year-old. In the Milking Shorthorns the three-year-old and four-year-old classes are sparsely represented, and possibly the influence of individual records is considerable. This, however, can scarcely apply to the Jerseys, and there is no apparent explanation beyond the fact that the mature class appears to have been a somewhat weak one in comparison with the other classes for this breed.

Table 6 supplies an analysis of production for all breeds and for all cows tested 180 days or more. This analysis has been compiled in production groups of 50 lb. butterfat, and ranges from the lowest individual yield to the highest.

Table 6.

Breed.	50 to 100.	100 to 150.	150 to 200.	200 to 250.	250 to 300.	300 to 350.	350 to 400.	400 to 450.	450 to 500.	500 to 550.	550 to 600.	600 to 650.	Total for Breed.
Jersey	2	11	44	84	153	147	92	49	13	6	3	1	605
Friesian	..	28	59	82	86	63	38	16	3	1	..	..	376
Ayrshire	..	13	13	11	15	11	2	..	..	..	..	..	65
Milking Shorthorn ..	..	5	16	11	13	6	1	1	..	..	..	..	53
Red Poll	..	1	3	6	11	5	1	1	..	..	..	..	28
Total, all cows	2	58	135	194	278	232	134	67	16	7	3	1	1,127

This table is an important one, because it indicates clearly where the cows which are lowering the average lie. As is to be expected, the most heavily represented classes are those round about the average yield, and particularly where the average itself falls. One or two interesting comparisons are relevant here. In the first place, if we take for a basis the production of the average New Zealand cow for last year—namely, 200 lb. butterfat—we find that 932 of the cows under review equalled or exceeded that production. Moving a step further, and taking as a basis last year's average ordinary herd-tested cow, with 240·48 lb. butterfat,* we find that over 800 of these O.H.T. cows exceeded that yield.

The highest number of cows placed under O.H.T. in any one herd was fifty-nine; the lowest, one. For the period under review there were altogether one hundred and eight herds on official herd-test out of a maximum of approximately two hundred on certificate-of-record test. At the peak of the year there was an average of 3·2 C.O.R. cows per C.O.R. breeder, as compared with 3·4 for the previous year, so that, when all influencing factors are taken into consideration, the O.H.T. apparently has not adversely affected C.O.R. entries.

We are now launched on the 1928–29 season, and prospects for O.H.T. entries are satisfactory. Breeders appear to be realizing that this system has been instituted for their benefit, and that it must ultimately result in improvement of our dairy herds.

* See *Journal* for October, 1927, page 215.

Foot-rot in Sheep.—The District Superintendent, Live-stock Division, Christchurch (Mr. J. Kerrigan, M.R.C.V.S.), reports a considerable occurrence of foot-rot among sheep in Canterbury during the past season. He attributes this to the lengthy spell of humid weather conditions experienced, together with a great growth of soft pasturage. Under such circumstances he advises farmers to anticipate the trouble and to take preventive measures by giving the sheep a foot-bath of one of the prescribed solutions, or by running them through a gateway where some slaked burnt lime has been placed.

UNTHRIFTINESS AND MORTALITY AMONG LAMBS AND HOGGETS.

THE PAST SEASON'S EXPERIENCE IN CANTERBURY.

J. KERRIGAN, M.R.C.V.S., District Superintendent, Live-stock Division, Christchurch.

THE past season proved an anxious one for many of the producers of fat lambs and owners of hoggets in Canterbury, and it is understood that this was more or less the case in some other parts of the South Island. The lambing throughout Canterbury was, in general, a good one, and there was every expectation that the fat lambs coming forward to the freezing-works would exceed the usual number, especially during the early months of the killing season. These expectations were not realized. The experience of most of the Canterbury works was that from January to the end of April, and probably well into May, the fat lambs did not come forward as freely as usual; moreover, that many lines were not in the usual good condition and contained a large number of second-class carcasses and a larger proportion of rejects than normally.

Many farmers experienced difficulty in fattening their lambs; consequently many lambs that were tending to go back in condition were sold and sent to the works. Fortunately, good prices were ruling and there was a demand for light lambs, which saved producers suffering as great a monetary loss as might have been the case. In one district, where a large area of the soil is of a clayey nature, many of the farmers were able to get only about 50 per cent. of their usual number of fat lambs ready for the works.

About the end of March several sheep-farmers mentioned to me that their lambs and hoggets were not thriving—in fact, that they were going back in condition and odd ones were dying. Owing to the prevailing weather conditions I was anticipating some such trouble, and advised them, if possible, to give their lambs and hoggets a change on to land where the feed was inclined to be dry, and to assist them by giving some crushed oats mixed in chaff or some good hay, &c. At a later date these farmers told me that when once they got their stock to take to the dry feed they began to improve and deaths ceased.

From the end of March onwards farmers from various places all over the Canterbury Plains asked for advice regarding the unthrifty condition of their hoggets and the varying mortality occurring among them. Our staff Veterinarians in Canterbury visited such places, investigated matters, and gave owners advice according to the circumstances. The Officer in Charge of the Wallaceville Veterinary Laboratory also visited some of the affected flocks and secured specimens for examination. Specimens from affected hoggets were also sent to him by the Veterinarians. The Inspectors of Stock in each of the districts also gave as much assistance as possible in spreading useful information.

Mr. A. M. Paterson, Veterinarian, Timaru, reporting on his experience of the trouble in the South Canterbury districts, remarked as follows :—

The first cases reported concerned hoggets that had been bought in, and which had been bred in the hills. As the season advanced, however, home-bred animals also were found to be affected as badly as the hill-bred ones. In this district the usual procedure is to place hoggets brought from the hills on to grass, then on to grass and rape or grass and turnips, with a run off on to grass and stubble. Occasionally chaff and hay are given, and, very exceptionally, oats. It was in the first stage of this routine that the disease made its appearance—that is to say, when the animals were on new grass with a run off to older pastures. It was also observed that among animals on rape and grass the disease was not nearly so serious, and among those on turnips it was least severe of all. The first symptom noticed by farmers was scouring, but as this was not uncommon among hoggets every winter nothing out of the usual was suspected. Intestinal parasites (worms) were looked upon as the cause of the scouring, and in most cases treatment for these was begun straight away, each farmer using his favourite drench, pill, or powder, according to what experience had taught him to rely upon. All such treatment proved powerless in staying the disease. Coughing was the next symptom noticed, and, lung-worm being suspected, all the old-fashioned remedies for these were tried along with newer drugs, but again without making any impression on the trouble. In spite of all medicaments the affected animals became more languid, more and more emaciated, and many died.

Affected hoggets, at different stages of the disease, were killed and post-mortems made on these, also on hoggets that had succumbed, and, although the results varied according to the stage at which the trouble was taken, all the Veterinarians found practically the same conditions present at similar stages of the disease. Mr. C. S. M. Hopkirk, Officer in Charge of the Wallaceville Laboratory, who in company with Mr. Paterson made post-mortem examinations at the various places where mortalities were occurring in South Canterbury, states as follows in the course of a report :—

An examination of a lamb or hogget following death gave a definite picture early in the season, but was less definite later when the tail of the flock was dying from inanition. Lung-worms were in all cases present, and one of the features of the flock in the latter part of the season was coughing. Pneumonia was not prevalent ; some fluid was found round the heart, and petechiæ on the outside wall of the heart ; the fourth stomach (abomasum) was extremely congested and thickened with œdema. The intestines and cæcum in each case were generally patchily congested ; the contents of the alimentary tract were pasty in appearance, and not the usual dark material seen in sheeps' intestines. Amber-coloured fluid was sometimes present in the peritoneal cavity, and occasionally a little peritonitis was noted. Examination for parasites revealed only a few in the fourth stomach in the majority of cases, many more being found present in the contents of the small intestines where they had passed from the stomach. The round worm (*Ostertagia circumcincta*)—in size about ¼ in. to ½ in. long, and finer than a very fine hair—was the usual stomach-worm found present. A number of whip-worms (*Trichocephalus affinis*) were also found attached to the mucous membrane of the cæcum.

The Veterinarians, who had the opportunity of examining affected hoggets over a considerable period, had no difficulty at certain times in finding large numbers of parasites in the alimentary tract, and also at times in the lungs and bronchial tubes.

When a survey is made of the weather conditions which prevailed during the period when the unthrifty condition and mortality occurred, it will be noted that unusually damp weather occurred during the last three months of 1927. The rainfall probably was not

excessive—in fact, the rainfall for the whole year was below normal —but there were frequent showers and considerably more wet days than usual, and a noted absence of drying north-west winds. The lambs made good progress during the first two months from birth, after which many of them progressed only slowly or did not progress at all and were inclined to be unthrifty. A short spell of better conditions was experienced in the months of January and February, after which the weather was damp and muggy, with an absence of winds, especially nor'westers, right through the harvest and well into winter. So unfavourable was the weather that in many instances farmers had difficulty in harvesting their crops, and the stooks remained in the fields awaiting stacking or threshing until the grain began to sprout. During the late autumn and on into the winter there was an unusual growth of grass of a soft, watery nature, and lambs and hoggets feeding on this in many instances became unthrifty. It was also noted that the winter was mild and that there were few frosty days.

Regarding the cause of the trouble, Mr. Paterson remarked :—

The general opinion is that the unusual nature of the season was responsible, to a greater or less degree, for the trouble. The autumn was dull, sunless, and windless, mild and showery, and there was an unusual growth of grass. Although farmers formed many opinions about the trouble, it cannot be doubted that it was caused by a lowering of the defences of the body by the innutritious nature of the grass on which the animals were fed during the latter part of March, followed by a serious parasitic infestation of the lungs, stomach, and intestines.

Mr. Hopkirk, in his report, takes a similar view :—

The warm weather and rainfall in the autumn brought away a tremendous growth of a soft, luscious feed, poorly balanced as regards proportion of solids to water content. The lambs and hoggets were therefore to all intents starved, although on pasture which one might consider good. Starvation increased unless hard food was at once brought into use, or unless the animals were moved on to older pasture or tussock. As the lambs and hoggets declined in health they became a prey for parasites, &c.

It will be evident that the opinion of the officers who investigated the trouble in Canterbury is, briefly, that the unusual weather conditions over the period and the abnormal growth of soft luscious grass during the autumn and winter caused an unthrifty condition among the lambs and hoggets, and that this predisposed them to parasitic affections of the digestive organs and lungs, resulting in a mortality of varying intensity according to the circumstances. This is also my own opinion of the matter. The unthrifty condition of the lambs and the mortality among hoggets were noted to be more prevalent on land which was inclined to be clayey, wet, or of a heavy nature, and the mortality varied in different flocks from a loss of odd hoggets now and again up to over 25 per cent. in special cases.

Mr. Hopkirk, in his laboratory work, by bacteriological tests also found in some specimens at *certain stages* paratyphoid organisms (related to the dysentery group of bacteria which set up dysentery in man) present in large numbers, and he is inclined to the opinion that these organisms accentuated the trouble. He was unable, however, by feeding the organism alone to starved lambs to produce scouring.

TREATMENT AND PREVENTION.

The best results were obtained when the affected animals were changed on to good dry pasture, and assisted with some supplementary dry feed, such as crushed oats in chaff, hay, &c. Also, many of the owners considered that medicinal treatment, such as proprietary tabloids for worms, a mixture of kerol and salt put out in boxes, the 1-per-cent. solution of copper sulphate recommended in suitable doses by officers of the Department, and other medicinal agents, together with the above-mentioned change of food, were a considerable aid in helping to overcome the trouble.

Here a word of warning may be given regarding the drenching of sheep. It should be done with every possible care; if done hurriedly or carelessly the medicinal solution is liable to get into the bronchial tubes and cause pneumonia and bronchitis, resulting in the death of the animal. This actually did occur in several cases, and in one particular instance about 50 per cent. of the mortality was caused in this manner. In other instances good results were obtained when affected animals were put on to sound turnips on dry land, and this supplemented with oaten chaff or crushed oats mixed in chaff. Naturally, the best results were obtained when treatment was commenced early, and before the hoggets were too badly affected and weak for treatment to assist them to recover.

I am of the opinion that if owners of lambs and hoggets, especially in such a season as the one under review, would carefully note any tendency of their stock to become unthrifty, and give them a change on to dry feed, supplementing this with a small quantity of crushed oats in chaff, or even just supply the latter, such troubles as here referred to would be greatly reduced—in fact, would become insignificant. I am also of the opinion that in many instances it would pay to top off the lambs for the meat-freezing works by supplying a small quantity of crushed oats or this mixed in chaff, especially where the lambs are on soil of a clayey or heavy nature, and the grass not that nice short sweet feed suitable for sheep.

It should be clearly understood that the trouble which forms the subject of the foregoing article was not the disease commonly known as pulpy kidney of lambs.

It may also be noted that the unthrifty condition and mortality among the flocks, as referred to, was confined to the plains and foothills of the province. In comparison the back-country (hill) sheep did excellently during the same season.

Cinnabar Moth and Ragwort Control.—A message from Nelson states that the liberation of the cinnabar moth (*Tyria jacobææ*) for the control of ragwort will not be made this spring by the Cawthron Institute as formerly proposed. The reason is that, in reply to inquiries made by Dr. Miller, information has been received showing that the caterpillars of the moth have been known to attack and defoliate potatoes in England and Guernsey. Before a final decision is reached regarding the liberation of the moth further extensive and detailed tests with potatoes and other plants will be first undertaken.

TOBACCO-CULTURE.

SIMPLE INSTRUCTIONS FOR SMALL GROWERS.

C. LOWE, Instructor in Tobacco Culture, Horticulture Division.

THE tobacco-plant is a native of South America, and, like the potato and the tomato, which come from the same region, is susceptible to frost. In New Zealand the plant has been grown successfully in the districts of Nelson, Hawke's Bay, and Auckland for a number of years, but it is only during the past ten years that it has come into prominence as a probable profitable side-line to other horticultural crops.

With proper culture, selection of suitable varieties, and proper curing, it has been established that leaf of good appearance and quality can be produced in this country. At present there is a fair demand for a high-grade quality of leaf, while for the poorer or inferior grades there is little or no demand. Samples of leaf have been sent to London, and the reports received, while encouraging, did not indicate the price which could be expected for leaf shipped in bulk. The London market is already fully supplied, and we can only hope to establish the New Zealand product on that market by exporting a high-grade leaf. In the circumstances intending growers should confine themselves to the culture of a hundred or so plants, so that they may become proficient, without serious loss to themselves, in the proper growing, fertilizing, management, and curing of tobacco. After becoming proficient, and before a larger area of tobacco is planted, due inquiry should be made as to the probable demand for the leaf at a payable price.

VARIETIES.

The question of a suitable variety of tobacco to grow in a particular locality will be governed largely by the soil and climatic conditions. Varieties for the leaf of which there is little or no demand should not be grown. It is advisable that pioneer growers in a district should test several varieties with a view to determining which variety is best suited to the respective localities.

It should be mentioned here that Virginian tobacco is a type of tobacco, not a variety. The varieties of the Virginian type which are recommended are Warne, Hickory Prior, Adcock, Judy's Pryde, and White Stem Oronoko. These varieties yield about the same crop per acre, and they will each kiln-cure.

SOIL, CLIMATE, AND AREA.

Tobacco-plants will grow on a wide range of soils. Soils lacking in organic matter and of poor nitrogenous content are preferable to soils rich in these materials, so that the supply of nitrogen may be controlled. The aim of fertilization in the production of high-grade tobacco is to furnish just sufficient available nitrogen to keep the plant growing vigorously up to " topping " time, but no further, so that the plants will be starved of nitrogen while they are maturing and ripening the leaf. Like other plants, we find that certain varieties thrive better on some soils than do other varieties. In this respect the Warne variety thrives well on soils which are of a light sandy nature and well

drained. Hickory Prior does well on good ordinary arable farming soils. Adcock and Judy's Pryde should be grown on a stiff clay soil to obtain the best results.

The situation selected should be well sheltered from winds. Frequently temporary shelter has to be provided, and this is usually planted after every fifteenth row. Maize provides a quick-growing suitable shelter; it should be planted some weeks before the tobacco is set out.

The optimum annual rainfall for tobacco-growing is from 30 in. to 40 in.

The area to be worked will largely depend on the amount of help that will be available for harvesting operations, shed accommodation, &c. Generally about 2 acres is as much as one man can manage to deal with successfully.

SEEDS AND SOWING.

The seed should be gathered from selected plants which have been properly grown for seed-production. For sowing, only the best warranted seed should be obtained. Poor seed only begets poor plants, which in turn causes loss and disappointment to the grower. The seed is very minute. A long ·22 empty Winchester rifle-cartridge will hold, when filled level with the top, about two thousand seeds. Seed-production should be left to a specialist so that uniformity in type and quality may be maintained. Both of these characteristics are of supreme importance in tobacco stocks.

The preparation of the tobacco seed-bed is similar to that for tomato-seed. The seed should be sown during July in boxes 18 in. by 12 in. by 3 in., in which 2 in. of sterilized well-rotted turf soil has been placed. The boxes should be placed in a glasshouse, where the conditions give quicker germination.

It is advisable, in order that the seed may be sown evenly, to practice sowing seed by using a piece of blotting-paper, 18 in. by 12 in., wet enough for the seed to rest on it. With a little practice one soon becomes proficient at sowing the seed evenly over the surface of the boxes. The seed may be sown out of a rifle-cartridge of the size already mentioned. In a glasshouse the seed will germinate in from ten to fourteen days, while outside it will take twenty-one days. The temperature of the glasshouse during the day should range up to 80° F., and should not fall below 40° at night. In five weeks the plants should be from ¾ in. to 1 in. high. Two thousand seeds should yield fifteen hundred good plants. The number of plants required to plant an acre is five thousand.

PRICKING OUT SEEDLINGS INTO NURSERY BEDS.

It is strongly advised that the plants should be pricked out of the seed-boxes into nursery beds. The pricking-out improves the lateral root-formation, as well as giving the plants richer soil and more room for development. Pricking out ensures a greater number of good plants of a uniform size. By 1st September the seedlings should be from ¾ in. to 1 in. high and ready for pricking out.

For convenience of working it is recommended that the nursery beds should be 12 ft. by 4 ft., with 9 in. timber round the borders of the beds. Extreme care should be exercised in the preparation of the soil for the beds, so as to get rid of any fungus harmful to the plants which may be in the soil. The soil should be sterilized by steam or fire. In the absence of appliances for steaming, gorse-roots or brush-wood should be piled on the soil and burnt. The soil should be reduced to a fine tilth, and passed through a ¼ in. mesh sifter; then 3 lb. of superphosphate and 4 lb. of carbonate of lime should be added and thoroughly mixed with the soil. The beds should be raised to a height of 5 in. or 6 in. above ground-level with prepared soil, and the soil graded over very carefully until the surface is level and smooth. To provide against the danger of late frosts and cold snaps, suitable covers and rollers should be provided to protect the plants against damage. To prevent damage from covers battens are nailed across the frame at suitable distances to keep the calico or scrim off the plants.

A planting-board is necessary to ensure the work being done quickly and neatly. The specifications for a suitable board are as follows: Timber, matai heartwood; lenth, 3 ft. 9 in.; thickness, ¾ in.; width, 4 in. On one side of the board make a 2 in. double bevel. Make some suitable marks at distances of 1½ in. apart on one side of board to mark positions for planting in the soil when the board is inserted into the ground.

With the planting-board open a small trench across the bed, and in it place the seedlings 1½ in. apart, carefully covering the roots. The opening of the next trench, 1½ in. distant, completes the closing of the trench already planted. In about five days the plants should have begun to establish themselves in the soil, and should be showing indications of further growth. From eight to ten days after planting, when the young plants are well established, water the plants with a solution of one egg-cupful of nitrate of soda to a kerosene tin of warm water. The plants usually grow quickly and will smother any weeds. The plants should be ready for planting out in the field by the beginning of November.

PREPARATION OF LAND.

Too little attention is generally given to the preparation of the land for tobacco-culture. The more thorough the cultivation the better the crop is likely to be; poorly prepared land seldom yields good crops. In the late autumn or early winter the land should be ploughed deeply, so as to completely cover all herbage. The burying of all grass and weeds is important, as by this means the food of caterpillars—which are a serious and destructive pest of tobacco-plants—is destroyed. The deep winter ploughing assists in the improvement of the drainage on the stiffer soils, and improves the texture of the soil, and makes it more congenial for the roots of the plant. It also assists in the conservation of moisture during dry spells in the growing-period.

The land should be reploughed in the early spring, but not so deep on this occasion as to bring up the sod turned under at the winter ploughing. The land should be worked regularly—say, every fortnight—after the spring ploughing up till the time of

planting at the beginning of November. It is important, too, that it should be cultivated after rains. Thorough working with disk and harrows is essential for reducing the land to a fine tilth.

Immediately before transplanting is to begin, the land should be levelled and smoothed with a plank drag. It is not advisable to use a roller, for this implement consolidates the ground too much.

MANURES AND FERTILIZERS.

Too rich a soil, and soils which have been too richly manured, cause the tobacco-plants to grow rank and wild. Such plants will produce a dark poor-quality leaf. The presence of readily soluble plant-food applied in the field causes the young plants to start away quickly and to make good vigorous growth while the slower-acting manures are becoming available. In order to obtain suitable growth, it is important that the proper combination of fertilizers be added to the soil.

Immediately after the winter ploughing, lime should be broadcast over the land at the rate of 1 ton per acre the first year and ½ ton each following year. For air-cured tobacco the following fertilizer mixture (per acre) is recommended in the case of new lands known to be poor: 5 cwt. superphosphate (44/46 per cent.), 1 cwt. sulphate of potash. Broadcast one-third of the manure one month after the lime has been applied. Work the fertilizer immediately into the soil. The plants are planted without manure. Ten days after planting apply the balance of the manure as described later. In soils poor in nitrogen it is advisable that the nitrates be added in a mineral form, such as nitrate of soda where quick action is required, or sulphate of ammonia where a slower-acting nitrate is desirable. Care should be exercised to use no more nitrate than is actually required; its use is mainly confined to sands, light sandy loam, and poor clay soils. Where it is intended to kiln-cure the leaf, the amount of sulphate of ammonia applied should not exceed 1½ cwt. per acre.

CONTROL OF PESTS AND DISEASES IN THE CROP.

Four or five days before planting, poison should be laid for cutworms and surface caterpillars. The best time of the day to lay the poison is about 4 p.m. Following is a good poison-bait recipe: Take 1 lb. Paris green, 3 lb. treacle, and 1 bushel bran. Boil the Paris green in 1 gallon water; pour the treacle into the boiling mixture and stir well, then take off fire; add the bran to the treacle and Paris green mixture, and work it up quickly by hand, preventing the mixture from forming lumps. Arsenate of lead, 2 lb., may be used instead of Paris green.

This material should be broadcast at the rate of 1 bushel per acre. One application is usually sufficient. Rain spoils the poison, and when rain falls before the poison has had an opportunity of being effective it should be resown. The poisoned bran should be sown with the assistance of the wind; the bran being thrown in the air, the wind will scatter it more or less evenly over the surface of the ground. The first night probably as many as 75 per cent. of the caterpillars will be poisoned. The cost of poisoning per acre is approximately 8s.

Following is brief information regarding insect pests: Wood-lice are troublesome in seed-boxes; apply flaked naphthalene. Black caterpillars are troublesome at planting; lay poisoned bran prior to planting

as above. Green caterpillars, wireworms, and leaf miners are troublesome later in season; pick off when observed and destroy by burning.

As regards fungus diseases, damping-off is troublesome during the seedling stage, leaf-spot during the growing-period, and mould during the curing-period.

PLANTING.

The rows of plants should run north and south. The rows are set 4 ft. apart, so as to allow of sufficient room for working the soil and harvesting operations. The plants are set 2 ft. apart in the rows. On this basis five thousand plants are planted to the acre. Any variation in these distances should only be made after the first season's experience of what the land will do.

The position for the first line of plants is marked out by a line of rods, which are 4 ft. long. Open a little furrow with the Planet Jr. (No. 17) implement, 3½ in. deep along the line of the markers. As the markers are reached they should be removed and placed in position for the next line, 4 ft. away from the first line. Each stake, being 4 ft. long, acts as a measuring-rod.

The plants should be lifted from the beds with plenty of soil attached to the roots, and placed in suitable carrying-tins. The planters follow the Planet Jr. implement. Soil which was thrown out in making the furrow is now carefully drawn back by hand on to the plants after placing them firmly in position; the return trip of the plough fills the furrow. The plants should be planted deeply in the manner described, so that the terminal bud is slightly below the level of the soil when planting operations are completed. This protects the plants from late frosts and drying winds, and gives them an opportunity of establishing themselves. No manure is applied at planting-time.

REPLACEMENT OF LOSSES.

In order to provide plants for replacing losses, it is the custom when planting to place the plants in every eighth row 1 ft. apart. By this means plants of age, development, and vitality and maturity of leaf equal to those in the field can be used for replacement of losses. It is important that the development and maturity of the plants throughout the field should be kept as even as possible. It is better to have gaps than a field of plants which are uneven in development and maturity. The filling-up of gaps should not extend beyond ten to fourteen days after planting. To replace, dig a suitable hole with a shovel or spade, then go to a nearby row having the extra plants, take up a good shovelful of soil with the plant, and carefully transfer it into the prepared hole without disturbing the roots. Alternate plants in the filler row should be left. Firm the soil about the plant, which should continue its growth as though it had been undisturbed. When the replacing has been completed, any unused plants intended for fillers should be cut off at the ground level. The fillers not required should not be left longer than one month after planting.

SUMMER TREATMENT.

Ten to fourteen days after planting the plants should be moulded up in a manner similar to that followed with potatoes.

The remaining two-thirds of the fertilizer recommended should now be applied to the soil along the furrows which have been created by the moulding. Cover the fertilizer immediately after sowing. A suitable method of distributing the fertilizer is to carry it in a bucket, and use a lid of a 2 oz.-tobacco-tin to distribute the manure. The rate of sowing is approximately a lidful to each plant.

After planting, the grower should continue to carefully work the land once a week and after rains. These cultivations should not be neglected, as they are an important factor in the production of good leaf. A suitable implement is the Planet Jr. (No. 17) wheel-hoe with three curved teeth.

The plants will run up quickly to their full stature. It will not be found practicable to work the soil much after Christmas-time without damaging the leaf. With a view to ripening off the leaf it is advisable that cultivation should cease after the plants have reached full height.

TOPPING, PRIMING, AND SUCKERING.

An average plant will have from ground to seed-buds twenty-two leaves. The practice is to top normal plants just above the twelfth leaf. In commencing tobacco-culture ten leaves is a good standard to work on, varying the practice according to the development of plant and leaves. If the plants are strong-growing and the leaves inclined to be coarse, increase the number of leaves on the following year's plants to twelve; if, on the other hand, the plants are weakly and the leaves of a papery texture, only eight leaves should be retained.

When growing for air-curing, the plants require to be topped when the first flower-buds are showing "pink." This will be about or shortly after Christmas, according to locality. The leaves (about three) at the bottom of the plant should be knocked off with the hands, so that the remaining leaves may be kept clear of the soil, and to permit of a free air movement in and around the plants. The three or four leaves at bottom — known as "lugs" — ripen earlier, are smaller, frequently damaged on the soil, and only about a quarter of the value of those higher up on the plant. The foliage requires as much sunlight as possible, and as the lower leaves are usually much shaded it is advisable that they should be removed to ensure an evenness of maturity in the crop of leaves to be harvested.

Count the leaves and top off. The leaves left on the plant should be fairly even in size. The tops and lower leaves removed should not be left underneath the plants, but put in the middle of the 4 ft.-wide rows, where they will soon dry up and go back to the soil.

If the crop is being grown for kiln-curing no priming is done. When the first flower-buds are showing pink, top back to point where the leaves are the size of laurel-leaves.

Lateral growths usually develop about ten days after topping. They should be removed when about 3 in. long. Disbudding will require attention about every ten days until the leaf is gathered.

The crop should be ripe from thirty to forty days after topping, according to the weather conditions—normally in the early part of February.

HARVESTING AND CURING THE LEAF.

For a shed-cured crop the grower should be guided by the four middle leave of the plants. They should be taking on a mottled appearance—the mottlings being about the size of a threepenny-piece. The texture of the leaves should be thick and dense in feeling; they should be crisp and break when bent. The bottom leaves will be fully ripe. For kiln-curing the leaves should be gathered when they appear to be ripe. It is estimated that a normal crop will produce 800 lb. of dried leaf per acre.

The tobacco is cured in partially open sheds or in kilns. Shed-curing is a slow method. In the case of people of small means the extra expense of building a suitable kiln would put kiln-curing out of the question. The cost of building a suitable kiln capable of dealing with 4 acres of tobacco would be about £100 to £112. One curing would take about three sacks of coke and two barrowfuls of wood. The labour wages for filling the barn and curing the leaf, where outside help was required to do this work, would be about £8 for each kilnful. The measurements of the kiln are 16 ft. by 16 ft., with sides 20 ft. high to the eaves. This is sufficient to hold five tiers of whole plants. A furnace is also required as a means of providing the necessary heat for the kiln.

Sheds or barns require to be well ventilated. Two ends should be open, so that winds may pass through the shed and down the rows of tobacco sticks and plants. Sacking or heavy scrim protections should be available for immediate use on the open ends, should occasion arise for these to be covered to protect the leaf hanging in the shed. The tobacco-sticks should run lengthwise so that the wind may pass down between the sticks. When the sticks are stored with green leaf they should be arranged 1 ft. apart. Later, when the leaves have dried to some extent, the distance between the sticks may be reduced to 8 in.

For shed drying the plants are cut off at or near the ground-line; when the dew has dried off them. The plants are tied in pairs. The green leaves should be handled with extreme care, as they are very easily broken or damaged, with consequent considerable loss in value; bruised leaves will not cure. The sticks are usually 4 ft. 3 in. long; eight pairs of plants are hung on a stick. The plants require to be placed in the drying-sheds out of the sun without any undue delay.

The leaf at first turns a yellow colour, and then brown, as chemical and bacterial changes take place in it. The leaves should remain on the stalks until the midrib of the leaves is brown. Screw the ribs with the fingers to ascertain whether the moisture has evaporated sufficiently to permit of the stalks of the leaves being tied together for a considerable time without decay developing.

Another system of harvesting is to split the stem with a sharp knife to within 4 in. of the ground when the leaves appear to be ripe; select a warm sunny day for the work. The tobacco should be allowed to remain in the field for three days to dry out the stems. At the end of this time, if the stems are sufficiently dry, they should be cut off at

the ground-line. The plants should not be left lying in the sun, but hung over the curing-sticks and carried into the barn.

In neither case should the leaves be handled while they are very dry and brittle, otherwise they will break up and be a total loss. In a humid atmosphere the dry leaves reabsorb moisture, and when sufficiently pliable they may be handled carefully without damage. The leaves when ready are removed from the stalks, graded, and tied in "hands" of twenty leaves. The leaves may be rehung again in the barn, and must be kept dry and reasonably warm so as to avoid the development of mould.

The warning indication of mould is a sour, dank smell. It develops and spreads quickly on the leaves when conditions are suitable. Immediately it is observed a hole should be dug in the floor, a good log (one which will burn slowly for three days) laid in the hole and set on fire. When the fire has got a good hold cover the burning log carefully with dry ashes. The result should be that a small quantity of blue smoke is disseminated through the shed.

The method of harvesting for kiln curing is for the leaf to be gathered as it is ready, beginning at the bottom of the plants and working up. Some of the lower leaves, through damage and dirt, may be of no use except for making tobacco-spray for insecticidal purposes. The picker picks in two rows of plants and takes off the lower leaves first; the remainder are taken as they ripen. The leaves taken at each picking should be as even as possible in respect to colour and maturity. The picker carefully places the leaves on a stretcher made from two wooden bars to which have been nailed fruit-case lids. When fully laden the stretchers are carried to a point, preferably in the shade, where the leaf is graded and put on a curing-stick 4 ft. 3 in. long and standing on a trestle. The laden sticks are taken to the kilns and placed in position for the curing process. When placed in the barn the bottom tier should be at least 7 ft. from the ground. The tips of the leaves above should be distant from 3 in. to 4 in. from the stems of the leaves on the tier below.

Kiln curing should be carried out in conformity with the flue-barn chart issued by the Horticulture Division, Wellington. Plans for useful sheds for air-curing, built with bush poles, thatched roof, and manuka sides, can also be obtained from the Division. After curing the leaf is stored in a dry warm building, when it is carrying 12 per cent. of moisture.

The shed-cured tobacco-leaves must be stripped carefully from the stalks when they have been cured and have become sufficiently pliable to handle. They should be graded according to the specified grades, and tied up in hands of from fifteen to twenty leaves, according to the thickness of the midribs. For bulking down the moisture should be right—neither too dry nor too wet; 12 per cent. of moisture is considered to be the correct thing. To some extent this is indicated by the feel of the leaf, which should be similar to that of an old leather glove. When the leaf is crushed in the hand and released the creases should come out almost at once. The leaves are laid in bulk to a height of 3 ft. A board or other suitable material is laid on top and weighted down with stones of moderate weight. The bulk leaf should be protected from drying or moistening influences.

Finally, the cured leaf should be carefully packed in bales or other suitable containers for transport to the receiving-store.

IMPERIAL AGRICULTURAL RESEARCH CONFERENCE, 1927.

OFFICIAL REPORT OF THE NEW ZEALAND DELEGATES.

THE following report concerning the Imperial Agricultural Research Conference held in London last year, by Dr. C. J. Reakes and Mr. T. Rigg, the New Zealand delegates, is attached to the annual report of the Department of Agriculture for 1927–28, presented to Parliament this month :—

Recognizing the profound influence which agriculture is destined to exert in the future in the promotion of the prosperity of the Empire and the happiness of its people, the Governments of Great Britain and of the Dominions have tried earnestly since the conclusion of the war to improve the status of agriculture in their respective countries. The importance of surveying the problems of agriculture throughout the Empire, of co-ordinating research work, of effecting a better utilization of the results of research, and of training efficient workers was recommended by the Imperial Conference of 1926 for the sympathetic consideration of the respective Governments of the Empire.

It was therefore not surprising that with the advent of the Empire Marketing Board and the stimulus given to agricultural research by its efforts the invitation of the British Ministry of Agriculture to the Dominions, Crown colonies, and dependencies, to send delegates to an Imperial Agricultural Conference in England met with ready acceptance from all parts of the Empire.

No effort was spared by the Ministry of Agriculture or the Empire Marketing Board, which defrayed the cost of all secretarial work and of the entertainment of delegates in England, to make the Conference in the highest degree successful. The Governments of the Dominions and the Colonial Office contributed in no small measure to the success by sending their representatives to attend the Conference and take part in its proceedings. The Conference was supported whole-heartedly by the agricultural-research stations of Great Britain, and every facility was granted overseas delegates to inspect the work which was being carried out and to discuss with the scientific staffs at these stations problems of mutual interest.

Too much stress cannot be laid on the value to agriculture which accrued from the opportunities thus afforded delegates of meeting one another and of discussing their work. In many cases it was realized, in some cases for the first time, that workers in other parts of the Empire were investigating similar or allied problems. Frequently a new approach to a particular problem resulted from the discussions which took place.

WORK OF THE CONFERENCE.

Early in the proceedings of the Conference it was clearly recognized that matters of broad policy affecting the development of agriculture in every part of the Empire deserved special consideration by the Conference as a whole. Such questions as follow were all matters of great importance to every part of the Empire, and were considered in detail by the Conference :—

(1) The establishment of Imperial bureaux and information centres for various branches of agricultural science.

(2) The collection and dissemination of information on agricultural problems throughout the Empire.
(3) The desirability of creating special research stations for the investigation of particular problems.
(4) The recruitment and training of agricultural workers.
(5) The establishment of permanent machinery which could conduct the secretarial work of the Conference and of other conferences which might be arranged in the future.

Specialist Commissions of technical and research officers met during the course of the Conference to consider the needs of agricultural research in different branches of agricultural science. Many valuable recommendations were submitted by these Commissions to the Conference.

Among the important matters which were considered in detail by the Administrative Commissions of the Conference, those relating to (1) the dissemination of information, and (2) the creation of Imperial bureaux and information centres were of great importance to all the Dominions.

In the past, agricultural officers in the Dominions have been dependent to a very large extent on the fundamental knowledge which has been gained by many famous research stations in Great Britain and Europe, often by prolonged and deep research, and Dominion workers have effected a practical solution of many problems confronting the agriculture of their countries by the application of such fundamental knowledge to their own particular conditions. While it is highly desirable that the value of fundamental research should receive the fullest recognition, direct attacks upon the great economic problems of agriculture in the Dominions must remain for many years the prime consideration of our workers. In the solution of such Dominion problems specific fundamental research will frequently be required, but the efficient application of existing knowledge must constitute the first line of attack.

In many cases it will be found that Dominion workers who are in touch with the progress of fundamental research in Great Britain and other countries will be able to suggest a practical solution of the problem confronting them. Full success in the solution of economic problems, however, is not likely to be obtained unless well-trained officers are available who keep abreast of the development of research work in other countries.

CO-OPERATION IN AGRICULTURAL RESEARCH.

One of the most valuable results of the Conference should be the coordination of agricultural research throughout the Empire. This should eliminate unnecessary duplication of effort, and should release both personnel and money for direct attacks on many economic problems which await solution.

The proposed Imperial bureaux and information centres should play an important part in economizing effort and in co-ordinating agricultural research. It was definitely recommended by the Conference that the bureaux and information centres should collect data and information in specific branches of agricultural science not only from all parts of the Empire but also from other sources throughout the world. One of the important functions of the bureaux and information centres will be the dissemination of this knowledge to individual workers in different parts of the Empire. In order that the greatest benefit may be secured from the work of the more famous research stations in Great Britain, it was recommended that the bureaux and information centres should be attached to particular research stations. This should ensure reliability in the information disseminated and help to bring about personal contact between overseas investigators and officers conducting research in Great Britain.

It will be possible for the bureaux to establish contact between workers in different parts of the Empire who are investigating similar problems. By this means they will be enabled to compare notes and interim results. In such cases one might expect the development of new lines of approach to a problem greatly hastening thereby its solution.

Where problems of general importance to several parts of the Empire are encountered arrangements will, no doubt, be made through the bureaux and information centres for a concentration of effort by some particular research station on such problems. Workers in other parts of the Empire would then be able to co-operate by the prosecution of research on some aspect of the problem which was of particular importance to their own country.

Co-ordination of research in the Empire cannot be attained without the support of scientific workers. The opportunities afforded by the Conference for discussions between workers from many parts of the Empire were of great value in establishing a real understanding between workers engaged on similar activities. The personal contacts made by Dominion workers should prove invaluable in the prosecution of their work. It will render possible much greater freedom of inquiry and of discussion.

The Conference unanimously endorsed the suggestion of periodical conferences for agricultural workers. In certain parts of the Empire regional conferences of specialist officers should prove of the utmost value.

Delegates were impressed with the importance of securing study-leave for isolated workers, and of facilitating an interchange of visits between workers in different parts of the Empire.

The recommendations of the Conference envisage the establishment of Imperial bureaux in the following branches of agricultural research :—

(*a*) Soil science. (Bureau to be attached to the Rothamsted Experimental Station.)

(*b*) Animal nutrition. (Bureau to be attached to the Rowett Institute.)

(*c*) Animal health. (Bureau to be established in London.)

In addition to these bureaux, the establishment of clearing-stations for information were recommended in the following subjects :—

(*a*) Animal genetics. (Station to be attached to Animal-breeding Research Department, Edinburgh University.)

(*b*) Agricultural parasitology. (Station to be attached to the Institute of Agricultural Parasitology, London.)

(*c*) Plant genetics. (One station to be attached to the Plant-breeding Institute, Cambridge University, to deal with all crops of temperate and tropical regions except herbage plants.)

(*d*) Another station to be attached to the Welsh Plant-breeding Station at Aberystwyth to deal with herbage plants.

(*e*) Fruit-production. (Station to be attached to the East Malling Research Station, Kent.)

The subjects to which the proposed bureaux and correspondence centres have reference are equally important in their bearing on agriculture to all parts of the Empire. It is a matter of congratulation that in almost every case the bureaux and information centres will be attached to research stations where much active work on the particular subject to which the bureaux and centres have reference is being pursued.

The suggestion that facilities should be made available through these Imperial bureaux for the training of selected Dominion workers met with the hearty approval of the Conference, and will extend still further the valuable work which the proposed bureaux and information centres will undertake for the development of agriculture in the Empire.

WORK OF THE TECHNICAL COMMITTEES.

Much valuable work was done by the technical committees which were established to consider the needs of research in different branches of agricultural science. Recommendations were made by these committees on the necessity or otherwise of creating clearing-houses for information in different subjects, on the functions of bureaux, and their organization to serve the special needs of different branches of science. Joint programmes of research between different parts of the Empire were considered, and the use of standard methods for experimental work was earnestly recommended.

Special problems requiring urgent consideration were brought to the notice of the Conference so that definite action could be taken by the responsible authorities.

PASTURE TOP-DRESSING EXPERIMENTS IN SOUTH OTAGO.

RESULTS OF TWO-YEAR PLOTS, SEASONS 1926–27 AND 1927–28.

R. B. TENNENT, N.D.D., Fields Superintendent, Dunedin.

DURING the season of 1926–27 three pasture top-dressing experimental plots were laid down in South Otago. These were designed to test the efficacy of superphosphate, basic slag alone, and slag in conjunction with lime; the effect of lime alone on grassland was also included in the scheme. The pastures selected were situated on soils representative of a large area of country, and it was anticipated that from the accurate design of the experiments, valuable information would be obtained.

Details of these plots were given in the *Journal* for May, 1927, and it is not necessary here to recapitulate particulars of their lay-out. It will suffice to say that in the case of the two plots at Crookston superphosphate (44–46 per cent. grade) and basic slag were applied at 2 cwt., and ground carbonate of lime at the rate of 1 ton, per acre. In the case of the Awamangu plot superphosphate (44–46 per cent.) was applied at 3¾ cwt., basic slag at 5½ cwt., and carbonate of lime at 1 ton, per acre.

The main object of the experiments was to determine the immediate effect of the various fertilizers in promoting the growth of grass and clover, and with a view to ascertaining the length of time over which the initial dressings would prove effective it was decided to keep the plots under observation for a period of at least four years. As a gauge for determining the effect of the various treatments the plots were closed to stock for a period of time sufficient to allow a hay crop to be taken, which would thus afford comparisons to be made. It is, of course, realized that this means of estimating the effect of the various fertilizers is at best not fully indicative; nevertheless, in conjunction with visual observations of the changes effected in the pasture constituents, it affords reasonable idea of just what reactions are taking place as a result of the different treatments.

The following tables give full particulars of the 1927–28 season's results, and also show the combined results for the two seasons under review.

Table 1.—D. Smollett, Awamangu : 1927–28 Season's Results.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Result: Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.		
		lb.		T.	Cwt.	Qr.
24	Basic slag	80·6	S	3	10	3
36	Basic slag and lime ..	82·6	S	3	12	1
24	Superphosphate ..	69·0	S	3	0	1
36	Super and lime ..	71·3	S	3	2	1
24	Lime	76·6	S	3	6	3
..	Control (no manure) ..	64·3	..	2	16	0

Table 2.—D. Smollett, Awamangu : Two Seasons' Results.

Manure.	Season 1926–27: Estimated Weight of Hay per Acre.			Season 1927–28: Estimated Weight of Hay per Acre.			Total value of Hay at £5 per Ton.			Cost of Manure.			Profit or Loss compared with Unmanured Plot.			
	T.	Cwt.	Qr.	T.	Cwt.	Qr.	£	s.	d.	£	s.	d.		£	s.	d.
Basic slag ..	2	11	1	3	10	3	30	10	0	1	13	0	Gain	6	7	0
Basic slag and lime	2	12	1	3	12	1	31	2	6	2	7	0	Gain	5	15	6
Superphosphate	1	15	0	3	0	1	23	16	3	1	2	6	Gain	0	3	9
Super and lime	1	16	2	3	2	1	24	13	9	1	16	6	Gain	0	7	3
Lime ..	1	16	0	3	6	3	25	13	9	0	14	0	Gain	2	9	9
Control ..	1	14	0	2	16	0	22	10	0		..			..		

Table 3.—I. D. Revie, Crookston : 1927–28 Season's Results.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Result: Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.		
		lb.		T.	Cwt.	Qr.
30	Basic slag	26·3	S	1	5	2
30	Basic slag and lime ..	23·3	N	1	0	1
30	Superphosphate ..	34·4	S	1	10	0
30	Super and lime ..	32·7	S	1	8	2
32	Lime	21·6	N	0	19	1
..	Control	21·3	..	0	18	2

Table 4.—I. D. Revie, Crookston : Two Seasons' Results.

Manure.	Season 1926–27: Estimated Weight of Hay per Acre.			Season 1927–28: Estimated Weight of Hay per Acre.			Total Value of Hay at £5 per Ton.			Cost of Manure.			Profit or Loss compared with Unmanured Plot.			
	T.	Cwt.	Qr.	T.	Cwt.	Qr.	£	s.	d.	£	s.	d.		£	s.	d.
Basic slag ..	1	10	3	1	5	2	14	1	3	0	15	7½	Gain	1	10	7
Basic slag and lime	1	8	1	1	0	1	12	2	6	1	9	7½	Loss	1	2	1
Superphosphate	1	16	1	1	10	0	16	11	3	0	15	3¾	Gain	4	1	0
Super and lime	1	16	0	1	8	2	16	2	6	1	9	3¾	Gain	2	18	3
Lime ..	1	7	3	0	19	1	11	15	0	0	14	0	Loss	0	14	0
Control ..	1	8	2	0	18	2	11	15	0		..			.		

Table 5.—W. H. Lusk, Crookston : 1927–28 Season's Results.

Number of Paired Plots.	Manure.	Mean Green Weight of Plot.	Result: Significant (S) or Non-significant (N).	Estimated Weight of Hay per Acre.
		lb.		T. Cwt. Qr.
24	Basic slag	48·3	S	2 2 1
24	Basic slag and lime ..	42·0	N	1 16 3
24	Superphosphate ..	52·9	S	2 6 1
24	Super and lime ..	46·1	S	2 0 1
30	Lime	41·3	N	1 16 0
..	Control	41·2	..	1 16 0

Table 6. W. H. Lusk, Crookston : Two Seasons' Results.

Manure.	Season 1926–27: Estimated Weight of Hay per Acre.			Season 1927–28: Estimated Weight of Hay per Acre.			Total Value of Hay at £5 per Ton.			Cost of Manure.			Profit or Loss compared with Unmanured Plot.			
	T.	Cwt.	Qr.	T.	Cwt.	Qr.	£	s.	d.	£	s.	d.		£	s.	d.
Basic slag ..	1	2	3	2	2	1	16	5	0	0	15	7½	Gain	0	15	8
Basic slag and lime	1	1	2	1	16	3	14	11	3	1	9	7½	Loss	1	12	1
Superphosphate	1	6	2	2	6	1	18	3	9	0	15	3¾	Gain	2	14	9
Super and lime	1	6	1	2	0	1	16	12	6	1	9	3¾	Gain	0	9	6
Lime ..	1	1	3	1	16	0	14	8	9	0	14	0	Loss	0	15	0
Control ..	1	2	3	1	16	0	14	13	9		..				..	

As will be seen from the tables, the effect of various phosphate dressings has been to provide an increased growth of grass over the unmanured strips. It seems remarkable that even after two years' application there has been no effect from the application of carbonate of lime on the two Crookston plots. These soils showed a definite "lime-requirement," yet so far as visual observation is concerned no appreciable difference in growth can be noted. At the conclusion of these experiments it is hoped to make a point analysis of each pasture, so as to determine the varying percentage of pasture constituents on each series of treatments. An endeavour has been made above to fix a monetary value to each treatment, but in so doing it is to be borne in mind that although the hay taken off the plots has been valued at the high figure of £5 per ton, that hay merely represents the produce derived from the plot over the comparatively short time of from ten to twelve weeks. A, full appreciation of the effect of the original dressings cannot be obtained until the completion of this experiment. This brief account should be regarded merely as a progress report.

The writer's thanks are due for the facilities and assistance given by the farmers concerned in the experiments, and acknowledgment is made to Messrs. A. S. Duff and A. A. Hume, of the Fields Division Staff, for their help in recording the results.

HOT-WATER TREATMENT OF SEED BARLEY.

FIELD EXPERIMENTS IN CANTERBURY, SEASON 1927–28.

C. H. Hewlett, Canterbury (N.Z.) Seed Co., Ltd., Christchurch.

The following matter presents the practical results of the hot-water treatment of seed barley in the Ellesmere district of Canterbury for the season 1927–28. Results for the previous two seasons were published in the issue of this *Journal* for June, 1927.

The method of treatment employed was in essentials that of the previous season—a presoak of five to six hours in water at 60° to 70° F., followed by a dip of five minutes in water held at 127° F. Improvements in technique suggested by the previous season's experience resulted in this season's seed showing very little reduction in vigour of germination following treatment. The seed direct from treatment was sown on the Canterbury Seed Company's farms at Leeston and Lake Road, and was also supplied to a number of farmers growing barley on contract for the company in the Ellesmere district.

The following tables present a condensed summary of the actual harvest results from both treated and untreated seed.

Table 1.—Yield of Seed "Direct from Treatment" and of Untreated Seed.

Variety.	Treated. Number of Farms.	Treated. Acres.	Treated. Yield per Acre.	Untreated. Number of Farms.	Untreated. Acres.	Untreated. Yield per Acre.	Increased Yield over Untreated.	Total Acres.
			Bushels.			Bushels.	Per Cent.	
Archer Spratt ..	9	134	79·6	58	1,059	64·7	23·02	1,193
Chevallier ..	7	136	67·4	15	212	55·2	22·10	348
							Decrease	
Plumage.. ..	2	49	45·5	13	169	60·9	25·29	218
Plumage Archer ..	2	40	71·5	..	..	..	..	40
Goldthorpe Spratt	2	40	61·4	..	..	..	..	40
	22	399	..	86	1,440	..	..	1,839

Notes.—All treated seed was absolutely free from smut. One lot of direct-treated Plumage was drowned out, and the other one was sown too late. Yield figures are for firsts only.

The product shown in Table 1 was graded as follows:—

Table 2.—Grading of Product.

Quality.	Archer Spratt. Treated.	Archer Spratt. Untreated.	Chevallier. Treated.	Chevallier. Untreated.	Plumage. Treated.	Plumage. Untreated.	Plumage Archer. Treated.	Goldthorpe Spratt. Treated.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
First grade ..	91·71	75·46	97·0	53·84	14·7	93·44	100·0	100·0
Second grade..	8·29	19·10	3·0	40·01	85·3	6·02	..	..
Under grade ..	..	5·44	..	6·15	..	0·54	..	..
Total ..	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0

The difference in value per acre between the treated and untreated Archer Spratt and Chevallier barleys is as follows: Archer Spratt—Increased value of treated over untreated, £3 12s. 8d.; Chevallier—Increased value of treated over untreated, £2 9s. 9d.

It will be noticed that although the treated Chevallier and Archer Spratt gave an increase both in yield and quality compared with the untreated, the treated Plumage did not do as well as the untreated. The reason was that of the two lots of treated Plumage one lot was drowned out and should have been ploughed up and resown, and the other lot was sown too late. This in itself is a valuable lesson, showing that in agriculture, as in other industries, even with the very best of materials, skill and care are necessary to produce good results.

The crops, product of the treated seed, were inspected early in January, 1928, and again later by Mr. J. C. Neill, Field Mycologist, Department of Agriculture, and were found to be absolutely free from smut.

The results attained during the past season confirm the experiments of the two previous years. Over 400 acres of various varieties of directly treated seed were grown; the drills used were cleaned out and disinfected with a strong solution of formalin; the reapers and binders were treated in the same manner before reaping operations commenced; and the threshing-machines were also similarly treated before threshing. This was done with a view to prevent reinfection of the product, so as to enable sufficient seed to be saved this year to provide enough "once removed" seed to sow the whole of the Canterbury barley crops for the 1928–29 season, and thus eliminate the smuts from the bulk of the malting-barley crops of Canterbury. For this purpose both the Canterbury (N.Z.) Seed Co., Ltd., and New Zealand Breweries, Ltd., have arranged to use for seed purposes in their contracts only the seed "once removed from treatment," produced from the crops mentioned in Table 1.

The whole programme of experiments was carried out with the valued advice and assistance of Mr. J. C. Neill. Thanks are due to other members of the Agriculture Department for their assistance in various ways, also to Mr. H. Neave, the Seed Company's manager at Leeston, who superintended the sowing and harvesting operations.

Experiments have also been carried out on somewhat similar lines with about 1,000 acres of wheat and oats. This work is being continued, but is not yet far enough advanced for publication of results. Experiments will be continued during the coming season with barley, wheat, and oats.

"Finest" Grade of Butter and Cheese.—The Director of the Dairy Division touches on this matter in his annual report for 1927-28 as follows: "The use of 'finest' grade, which includes all creamery butter and factory cheese scoring 93 points and over, has been in operation throughout the year. Despite the difficulties experienced by butter and cheese makers in consistently manufacturing a highest-quality article, chiefly through the extremely dry weather conditions which prevailed, 68·33 per cent. of the butter and 34·15 per cent. of the cheese graded was classed in this highest grade. Evidence appears to be accumulating to the effect that 'finest' quality is worthy of a premium in price over 'first' grade."

CITRUS-CULTURE.

VARIETY AND ROOTSTOCK EXPERIMENTS AT TAURANGA, SEASONS 1926-27 AND 1927-28.

P. EVERETT, Orchard Instructor, Thames.

DEFINITE progress has been made in the establishment of commercial citrus plantations in New Zealand of late years. Many different varieties of lemons, oranges, limes, mandarins, and grape-fruits have been tested, not only by the Department of Agriculture but also by individual growers, and the knowledge so gained has been of considerable help to growers. The importance of selecting suitable rootstocks has also been amply demonstrated at Tauranga.

When the Department's Tauranga Horticultural Station was disposed of in 1923 the Manager, Mr. J. H. Davidson, undertook to carry on the citrus tests—both variety and rootstock—then under way. A progress report on these tests was made by him in 1926, and published in the April issue of this *Journal* that year, illustrated with a number of photographs. The present report deals with the subsequent development and existing condition of the trees under test, together with particulars of yields for the seasons 1926-27 and 1927-28, each season being reckoned from April to the following March. The crop records were kindly supplied by Mr. Davidson.

When considering the crop records (as given in the report on rootstocks) it should be borne in mind that throughout the Tauranga district there have been light crops of almost all citrus-fruits for the past three years. The 1927-28 season's crop was one of the lightest ever experienced in the Bay of Plenty, being in most cases almost a complete failure. The crop that is being harvested at the time of writing (July, 1928) is a heavy one, and it can safely be said that when the yield figures for the present season's crop are available a very large increase will be recorded.

Lemon Variety Tests.

Eureka.—This variety has made very strong growth, and is a more consistent cropper all the year round than most other varieties. The fruit is mostly a good even shape and large. The style of tree-growth is inclined to be straggly, and the fruit is largely borne near the tips of the branches. This weakness of the Eureka can be remedied, to a certain extent, by periodically shortening back the strong-growing young growth. The variety is a suitable one to plant for commercial purposes. The tree is thornless.

Lisbon.—In the 1926 report referred to, it was stated that this block of trees was then the poorest in the area, and that the rootstock were old and stunted when the trees were received from the nursery. In spite of these facts the trees are now making great growth annually, and are as large as trees of any other variety of the same age. For the two years under review they have averaged the heaviest crop. The fruit is mostly of good size and even shape. The trees are nicely compact and bushy. Buds on the lateral growth are closer together,

and more fruit is produced in the interior of the tree than is the case with Eureka. The Lisbon is a thorny variety, but the thorns are not sufficiently numerous to be a serious deterrent to the planting of this variety.

Villa Franca.—This is proving to be a fair commercial variety for Tauranga conditions. The trees are not so large as either Eureka or Lisbon, although the growth made is reasonably satisfactory. The variety has a good, stocky style of growth, and the buds on the lateral branches are close. The fruit is now mostly a good size and shape. It is a heavy summer bearer, which is decidedly in its favour. For the first four years of cropping the fruit was inclined to be spherical in shape, as the nipple did not grow out. During the last two years this undesirable characteristic has almost completely disappeared, except with the trees on Rangpur lime stocks, and with these the weakness is still very evident. The principal drawback to Villa Franca is the roughness of the fruit from young trees, and the fact that it is not quite such a vigorous grower as Lisbon or Eureka.

Messina.—The growth of the trees of this variety is in many ways similar to that of the Lisbon, but not so vigorous. The general habit of the tree is to form rigid upright growth, with the fruit and foliage mostly on the tips of branches. There are very few lateral fruiting-twigs and many bare branches. A considerable proportion of the fruit is inclined to be unduly elongated, which considerably reduces its commercial value. The tree is very thorny.

Genoa.—This variety has the drooping style of growth that is characteristic of Eureka, but with finer foliage and growth. It is not such a vigorous grower as Eureka, Lisbon, or Villa Franca. This is probably due largely to the heavy-cropping habit of the trees when very young. The fruit is the most attractive in appearance of any variety grown in the locality, being practically perfect in shape [illegible] very smooth. Some of the winter-crop fruit does not quite [illegible] the most suitable size for commercial purposes [illegible] of tree could be made to grow as vigorous[illegible] probably prove the most profitable [illegible] for about the first six years [illegible] possibly be done by preventing th[illegible]y crops of fruit while very young.

[illegible] *Rangpur (Acid) Limes.*—Both of these varieties [illegible] vigorous growers and heavy croppers, but the fruit is [illegible] There is practically no demand for this class of fruit, and such limes therefore cannot be recommended for commercial planting.

Lemon Rootstock Tests.

The crops indicated in the following notes are the average of all trees on the particular kind of stock; 150 lemons have been reckoned as one case. The age of the Messina trees is nine years and all other varieties ten years, reckoned from planting.

(1) Eureka on sweet orange: Trees are making good typical growth of the variety, and cropping well. Crop, 1926–27, 4 cases; 1927–28, 2·01 cases, per tree.

(2) Eureka on rough lemon: Trees and fruit similar in every way to No. 1, except that the trees are slightly larger and the crop a little heavier. Crop, 1926–27, 4·05 cases; 1927–28, 2·05 cases, per tree.

(3) Eureka on *Citrus trifoliata*: Trees extremely dwarfed and useless. Crop, 1926–27, 0·06 case; 1927–28, 0·03 case, per tree.

(4) Eureka on Rangpur lime: The growth of these trees is not equal to No. 1 or No. 2. A number of trees on this stock have been blown over at different times, due to the shallow-rooting habit of the Rangpur lime. The quality of the Eureka fruit is better on this stock than on any of the other stocks under test. Crop, 1926–27, 2·05 cases; 1927–28, 1·05 cases, per tree.

(5) Eureka on "ordinary" lemon: Considerably smaller tree than No. 1 and No. 2, but quality of fruit similar. Crop, 1926–27, 3 cases; 1927–28, 1·06 cases, per tree.

(6) Lisbon on sweet orange: All trees have made very great growth, and are bearing heavy crops of good average-quality fruit. Crop, 1926–27, 5 cases; 1927–28, 2·05 cases, per tree.

(7) Lisbon on rough lemon: The growth of these trees is almost equal to that of No. 6, but the crop is lighter and the fruit noticeably smaller. Crop, 1926–27, 2·05 cases; 1927–28, 1·05 cases, per tree.

(8) Lisbon on *Citrus trifoliata*: Poor tree-growth has been made as compared with No. 6 and No. 7, yet these trees are quite three times the size of the Eureka variety on the same stock. Heavy crops are being produced for the size of the trees. Crop, 1926–27, 2·01 cases; 1927–28, 1·05 cases, per tree.

(9) Lisbon on Rangpur lime: These trees have made slightly better growth than No. 6, and are the most vigorous-growing lemons in the whole of the test area. The fruit is equal in quality and similar in amount to No. 6. Crop, 1926–27, 4·02 cases; 1927–28, 2·02 cases, per tree.

(10) Villa Franca on rough lemon: The trees have not made very satisfactory growth, but are cropping well for the size of the trees. The fruit is a good average quality. Crop, 1926–27, 4 cases; 1927–28, 2 cases, per tree.

(11) Villa Franca on *Citrus trifoliata*: Very dwarfed trees and small fruit. Crop, 1926–27, 1·05 cases; 1927–28, 1·01 cases, per tree.

(12) Villa Franca on Rangpur lime: The growth of the trees is very similar to No. 10. As already mentioned, the nipple has not grown out on many of the fruits, making the lemons almost spherical in shape and badly wrinkled at the nipple end. This failing may disappear as the trees get older, as has already happened with this variety on the other stocks under test. Crop, 1926–27, 3·02 cases; 1927–28, 2·03 cases, per tree.

(13) Messina on rough lemon: The trees have not made very satisfactory growth, but are producing fair crops of medium-quality fruit. Crop, 1926–27, 3 cases; 1927–28, 2·02 cases, per tree.

(14) Messina on *Citrus trifoliata*: The trees are all extremely dwarfed and useless. Crop, 1926–27, 1 case; 1927–28, 0·07 case, per tree.

(15) Messina on Rangpur lime: Stronger growth has been made by these trees than No. 13; the quantity and quality of the fruit is about equal. Crop, 1926–27, 3 cases; 1927–28, 1·07 cases, per tree.

(16) Messina on sweet orange: The trees and fruit appear to be the same in every way as No. 13. (Crop records for these trees are not available).

(17) Genoa on rough lemon: Medium growth has been made by the trees, and they are bearing good crops for their size. The fruit from these trees, and from No. 18, has a more attractive appearance than any other grown in the area. It is particularly even in size and shape, and has a very smooth rind. Crop, 1926–27, 4 cases; 1927–28, 2·02 cases, per tree.

(18) Genoa on *Citrus trifoliata*: Trees extremely dwarfed and practically useless. Crop, 1926–27, 1·05 cases; 1927–28, 1 case, per tree.

(19) Genoa on Rangpur lime: The growth of these trees and the appearance of the fruit is practically identical with No. 16, but the crop has been lighter. Crop, 1926–27, 2·06 cases; 1927–28, 1·02 cases, per tree.

(20) Genoa on sweet orange: This stock does not appear to be so suitable for the Genoa variety as either the lime or rough lemon. Neither the growth of the trees nor the appearance of the fruit is equal to No. 16 and No. 18. (Crop records for these trees not available.)

Summary of Lemon Tests.

The results obtained so far from the different lemon variety and rootstock tests indicate that the three most suitable lemon-trees to grow for commercial purposes—in the locality of Tauranga, at least—are Lisbon on Rangpur lime or sweet orange, Genoa on rough lemon, and Eureka on rough lemon stocks. While the yields recorded above show that the crop for the past two seasons has been lighter on the Genoa than on either the Lisbon or Eureka, it must be borne in mind that the appearance of the Genoa fruit is better than that of either of the other two varieties.

Orange Varieties and Stocks.

Best's Seedless.—This is an extremely vigorous grower, but so far it has proved a very light cropper, and the trees are very thorny. The trees on sweet-orange stocks have not borne more than about a dozen fruits each in any one year. The one tree on Rangpur lime stock produced 0·05 case of fruit in each of the past two seasons, the fruit being all very large. Age of trees, ten years from planting.

Ruby Blood.—These trees are all on sweet-orange stocks, and have made medium growth. For several seasons past they have borne heavy crops for the size of tree. Much of the fruit does not attain the most desirable size for marketing. Age of trees, ten years from planting. Crop, 1926, 2 cases; 1927, 0·05 case, per tree.

Washington Navel.—The trees worked on sweet-orange stocks are making medium growth, and bearing heavy crops for the size of the trees. The fruit is a good medium size. The trees on Rangpur lime stock are dwarfed and the fruit very small. Age of trees, on Rangpur lime stocks, 9 years, and on sweet orange, ten years, from planting.

Crop, 1926, 2·05 cases on sweet-orange stock, and 1 case on Rangpur lime stock; 1927, 1·05 cases on sweet-orange stock, and 0·05 case on Rangpur lime stock.

Navelencia.—The trees are all on sweet-orange stocks and are making good growth. At the time of writing they are carrying a heavy crop of fruit of good commercial size. So far this variety has set a heavy crop only every other year, and in the off season only a few fruits have set. Age of trees, ten years from planting. Crop, 1926, 3 cases per tree; 1927, practically nil.

Thompson's Improved (Navel).—The trees on sweet-orange stocks have made good growth, and the fruit is a good commercial size. The trees on Rangpur lime stock have not made quite such good growth as those on the orange stock. The present (1928) crop is heavier on the Rangpur lime stock, but the fruit is smaller. This variety, like the Navelencia, has so far cropped only every other year. The age of some of the trees is ten years, and others eight years from planting. Crop, 1926, 2·05 cases per tree; 1927, practically nil. The crops were the same on both stocks.

St. Michael.—There is no appreciable difference in any way from the trees on sweet-orange stocks as compared with those on Rangpur lime stocks. The tree-growth in both cases is not as vigorous as that of most other varieties, and the fruit does not attain the most desirable size for marketing. The heavy crops borne by these trees for a number of years past has no doubt been responsible in a considerable measure for the poor tree-growth. The age of some trees is ten years, and of others eight years, from planting. Crop, 1926, 3 cases; 1927, 1·05 cases, per tree. The crops were the same on both orange and lime stocks.

Joppa.—The trees are all on sweet-orange stocks and have made good average growth, but so far have not borne a heavy crop. The fruit is small. Age of trees, ten years from planting. Crop, 1926, 0·05 case per tree; 1927, practically nil.

Jaffa.—These trees (also all on sweet-orange stocks) have not made quite such good growth as the Joppa variety. So far the trees have set only a very light crop, and the fruit is small. Age of trees, ten years from planting. Crop, 1926, 0·05 case per tree; 1927, practically nil.

Poorman.—Every tree of this variety in the test area is now bearing a heavy crop of good-type, large-size fruit. The trees on sweet-orange stocks have made excellent growth; those on Rangpur lime stocks are a little larger than those on the sweet-orange stock, in spite of the fact that they came into bearing a year sooner. While there is no great difference between the results obtained on the respective stocks, there can be no doubt that the Rangpur lime is preferable—for Tauranga conditions at least. Age of trees, ten years from planting. Crop on sweet-orange stock, 1926, 3 cases; 1927, 1·02 cases, per tree; crop on Rangpur lime stocks, 1926, 3·02 cases; 1927, 1·02 cases, per tree.

Valencia Late.—There is one tree only of this variety, and no records are available of its crop or age. It is probably not less than eighteen years old, and has borne heavy crops of fruit for many years. At the present time this tree is carrying in the vicinity of nine cases

of oranges. A good deal of the fruit is on the small side. The chief point in favour of this variety is the fact that the fruit will hang on the trees very much longer than with any other variety, and without losing its juice content.

Other Citrus Fruits.

March Seedless Grapefruit.—The trees are all making good growth, and have borne a medium crop of large-size fruit for several years past. The rind and pith of the fruit are very thick. Age of trees, nine years from planting.

Emperor Mandarin.—There is one tree only of this variety, which is now three years old from planting and is on sweet-orange stock. Unfortunately, this tree was severely injured soon after planting by being run over with disks; consequently poor growth has been made. This season the tree has produced about two dozen fruits, all of medium size.

Sampson Tangelo.—These trees (two only) were poorly grown and badly rooted when secured from the nursery a year ago. This fact, in conjunction with the exceptionally dry weather experienced during the past year, has resulted in very poor growth having been made by the trees. They were pruned before planting.

Ellendale Beauty Orange, Foster Grapefruit, Golden Nugget Orange, and Meyer Lemon.—There are only two trees of each of these varieties. The condition and age of all is the same as that of the Sampson Tangelo trees.

THE CHRISTOFLEAU METHOD OF ELECTRO-CULTURE.

THIS matter was brought up in the House of Representatives last month by Mr. H. Atmore, member for Nelson, who addressed the following question to the Minister of Agriculture: "Whether he can inform honourable members as to the value of the Christofleau method of electro-culture, on which large sums of money have been expended by orchardists and tomato-growers in installing the apparatus? (Note.—If the apparatus is known by experience in other countries to give valuable results to the worker on the land it is suggested that the fact should be made known, and that if it is of no use the agricultural public should be informed of the position.)"

The Minister replied as follows: "Experiments with this method of electro-culture have been carried out in New Zealand, but no benefit appears to have been derived from the process. This confirms information received from the authorities in Paris that the actual capacity of such apparatus to bring into play appreciable quantities of electrical energy capable of influencing the crops is practically nil, and that there is absolutely nothing to sustain the statements and declarations given in the explanatory pamphlets issued in connection with it, these being in direct opposition to the fundamental laws of electricity."

Bush-sickness Treatment.—In the *Journal* for June, 1928, page 403, "Farmer P" gave the result of his experience with citrate of ammonium and iron for the treatment of bush sickness in cattle. He wishes to correct an error which crept into the transcript of his notes. Instead of one heaped teaspoonful plus 2 quarts of bran being the dose used, this is the mixture made, the dose being one handful of this mixture.

ESTABLISHMENT OF BENEFICIAL INSECTS IN NEW ZEALAND.

SUMMARY OF RECENT WORK UNDER AGRICULTURE DEPARTMENT.

THE following notes provide a summary of the biological control operations of the entomological branch of the Fields Division during the year ended March, 1928. The work was under the control of Dr. D. Miller, then Government Entomologist attached to the Department of Agriculture, who has since resigned to take up the position of chief entomologist to the Cawthron Institute, Nelson. The summary was prepared by Dr. Miller.

Pear-midge Parasite.

The work of establishing the pear-midge parasite* referred to as Platygaster (*Misocyclops marchali* Kieff), was continued during the 1926–27 and 1927–28 seasons. The 1926–27 consignment from Europe gave most satisfactory results and enabled the establishment to be carried out on a sufficiently large scale.

In the autumn of 1927 the parasite was recovered in small numbers in the field at Henderson, near Auckland, in orchards where liberations had been made earlier in the season. In the spring of 1927 a very decided increase of parasites was noted in the field, correlated by marked improvement in the health of the trees and a decrease of midge infestation. As the season advanced, and until the autumn of 1928, the parasites were recovered in increasingly greater numbers. An outstanding feature was that in the spring of 1926, three female and one male parasites were liberated in an orchard at Stoke, near Nelson; and from midge-infested leaves collected in that orchard during January, 1928 (fifteen months later), large numbers of parasites were reared. It can be definitely stated that *M. marchali* is now well established at Henderson and at Stoke.

During December and January last large quantities of midge-infested foliage were collected from the Henderson orchards where the parasite is established, and distributed throughout the midge-infested areas of the Dominion. In localities outside the fireblight areas the adult parasites, and not the insect-infested pear-leaves, were distributed.

Sheep Maggot-fly Parasite.†

Owing to the influence of *Mormoniella brevicornis*, the rearing of *Alysia manducator* in the Department's insectaries received a serious setback until steps were taken to eliminate this secondary parasitism. The method employed was to give the larvæ parasitized by *Alysia* protection during pupation from the attacks of *Mormoniella*. In the cages used meat containing blow-fly larvæ exposed to *Alysia* was placed on earth about 1 ft. deep; the mature larvæ burrowed deeply

* The following former articles on the subject have appeared in this *Journal*: Vol. 32, pages 379–393 (1926); vol. 35, pages 107–111, and pages 170–175 (1927).

† For previous articles see this *Journal*, Vol. 34, pages 1–4; vol. 35, pages 219–220 (1927).

into this, mostly to the bottom of the earth, and there pupated. By this means *Alysia* was successfully reared in abundance and field liberations made during January, February, and March last.

For the successful arrival in New Zealand of the pear-midge and maggot-fly parasites thanks are due to the Director of the Imperial Bureau of Entomology, London, who was responsible for the location and collection of the parasites through the agency of Dr. J. G. Myers and Dr. R. C. Fisher.

Gum-tree Weevil Parasite.

As has been already recorded,* an egg-parasite (a species of Mymarid) was imported from Australia in October, 1927. The parasites reared from this consignment were used to infest weevil-eggs in the insectary, and from these, one month to six weeks later, the first New-Zealand-reared Mymarids were secured. So numerous were these Mymarids that most were liberated in the field, while the remainder were used to infest eggs in the insectary for future supplies.

The Mymarids were liberated at the following places: Henderson, Mangaiti, Orini, Waitapu, Waipukurau, Bulls, Marton, Palmerston North, Wellington, Blenheim, Motueka, and Darfield.

Grass-grub Parasite.

In New Zealand the grass-grub (*Odontria zealandica*) holds the same position as the June beetles and cockchafers do in North America and Europe respectively.

As the New Zealand grass-grub is remarkably free from infestation by parasites, it was decided to attempt the establishment in New Zealand of one or more of the parasites infesting Melolonthid larvæ in North America or Europe. As a preliminary step towards this development Dr. Arthur Gibson, Dominion Entomologist of Canada, was communicated with regarding the collection and shipment to New Zealand of June-beetle larvæ (*Lachnosterna* sp.) infested by larvæ of the Tachinid *Microthalma michiganensis*. Though this Tachinid and its host take two or more years in their development, and the New Zealand grass-grub one year, it was thought that the Tachinid might possibly adapt itself to New Zealand conditions, since in Canada it has been found at times to develop in a much shorter period than normally required.

Through the great generosity of Dr. Gibson three consignments of Tachinid-infested *Lachnosterna* larvæ have been sent to New Zealand. The material was collected by Dr. C. E. Petch, of the Canadian Government Laboratory, at Hemmingford, Quebec. In connection with the transport of the shipments we are much indebted to Mr. W. A. James (New Zealand Government Agent at Vancouver), to the Union Steamship Company of New Zealand, and to Mr. George Harnett (Port Fruit Inspector, Auckland).

Each consignment consisted of a number of tin-lined wooden cases containing numerous tins each enclosing a larva among earth. The small tins were placed in layers and separated by damp moss. Each

* See this *Journal*, vol. 35, pages 283–289 (1927).

consignment was sent in cool storage in the vegetable chamber of the ship. The first and second consignments, consisting of 1,060 larvæ in five cases, arrived in New Zealand in October, 1926. The larvæ were removed from the tins and placed in damp soil in well-ventilated emergence cases. A total of three Tachinids (all males) emerged during January, 1927, from both these consignments; two adult *Lachnosterna* also emerged.

The third consignment was received during December, 1927, and consisted of 1,800 larvæ in six cases. As with the first and second consignments, a number of the larvæ were found in a rotting state, and counts were made of the unhealthy and healthy specimens; the percentage of healthy larvæ in each of the six cases was as follows:—First case, 75; second, 80; third, 80; fourth, 79; fifth, 78; and sixth, 80 per cent. This illustrates a remarkable constancy in the health of the larvæ. The unhealthy ones, perhaps, were infected to some extent by a bacterial disease that causes mortality among the larvæ in Canada. Attempts were made to rear this pathogen, in the hope that it would be of use against the New Zealand grass-grub, but unsuccessfully.

When the third consignment was unpacked on 16th December, 1927, Tachinid puparia were found beside the remains of their host. The adult Tachinids commenced to emerge on 17th January, 1928, and continued until 31st March, a total of 103 being secured. On 17th January only one adult emerged, and another on the 24th. But from 25th January until 21st February the maximum emergences took place almost continuously, amounting to eighty-four in all. From the 22nd to the end of February three adults emerged. On 2nd and 5th March respectively ten emerged; on the 9th two, and finally one on the 30th and 31st. Adults lived in captivity for a period of eight days.

Field liberations of Tachinids were made in the Hutt Valley, Wellington (27/2/28), at Ashburton (1/2/28), and at Hororata, Canterbury (7/2/28); while others were liberated on 22nd February, 1928, in a large cage over pasture artificially infested with grass-grub.

Apart from the future of this Tachinid in New Zealand, an important feature of the attempted establishment is that material collected in the Northern Hemisphere during late autumn, when hibernation is about to commence or has already set in, can be shipped to New Zealand under moderately cold conditions for a period of four weeks, and that when submitted to summer conditions in the Southern Hemisphere both Tachinid and host develop to the adult stage without necessity for prolonged hibernation.

In relation to future attempts at the biological control of the New Zealand grass-grub, possibilities lie in the use of certain parasites of the Japanese beetle having a yearly cycle, and in the Mololonthid parasites of Australia and Europe. The Australian parasites have the advantage of existing under seasonal conditions similar to those of New Zealand, and in being nearer at hand.

The Kea Subsidy.—During the financial year 1927–28 the Agriculture Department's subsidy of 5s. per beak for destruction of the kea was paid on 3,053 birds, totalling £763 5s.—practically the same amount as in the preceding year.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1927–28.

Dairy Division.

LISTS of butter and cheese factories which have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1927, to 31st July, 1928—are here presented. It is satisfactory to note that, despite the exceptionally dry, hot summer experienced, the quality of butter has been well maintained, the number of butter-factories averaging 93 points and over being three in excess of the 1926–27 list. Cheese quality, however, has not been fully maintained. Contributing factors towards this have been the abnormal summer conditions, and the cessation of the payment made by the Dairy Produce Board of a premium of ¼d. per pound for "Finest" grade over and above that for "First" grade. Only twenty cheese-factories figure in this year's list, as against sixty-eight in last year's.

Company or Proprietor.	Registered No.	Brand.	Average Grade.
BUTTER-FACTORIES.			
Rangitikei	1360	Rangitikei ..	95·039
Wangaehu	1326	Wangaehu ..	94·774
Wairoa	1345	Wairoa ..	94·667
Waitaki	812	Waitaki	94·658
Taieri and Peninsula (Dunedin) ..	54	Taieri and Peninsula	94·574
Rata..	938	Rata	94·526
Awahuri	664	Red Rose	94·364
Levin	910	Levin	94·331
Shannon	1489	Shannon	94·260
Golden Coast	991	Golden Coast, &c. ..	94·197
Napier	169	Clive	94·166
Mangorei	345	Mangorei	94·147
Tolaga Bay	1007	Tolaga Bay ..	94·092
Midhirst	110	Rugby	94·050
Lepperton	49	Lepperton.. ..	94·036
Pio Pio	603	Pio Pio	93·977
Moa Farmers'	341	Inglewood.. ..	93·972
Kiwi	299	Kiwi	93·970
Kia Ora	926	Kia Ora	93·960
Rongotea	8	Rongotea	93·936
Kokotahi	1144	Kokotahi	93·917
Rangiwahia	750	Quail	93·896
Masterton	1307	Masterton ..	93·814
Okau	872	Okau	93·807
Raetihi	717	Raetihi	93·798
Waitara	726	Waitara	93·788
Heretaunga	1230	Heretaunga, &c. ..	93·750
Maketawa	342	M.D.C.	93·746
Farmers' Dairy Federation ..	336	Murihiki	93·734
Waipukurau	1455	Mount Vernon ..	93·711
Golden Coast	387	Golden Dawn ..	93·689
Tarata	631	Tarata	93·680
Golden Bay	146	Sovereign ..	93·636

Company or Proprietor.	Registered No.	Brand.	Average Grade.
		BUTTER-FACTORIES—*continued.*	
Taihape	1188	Tikapu	93·626
Bell Block	488	Bell Block	93·606
Palm	1838	Palmerston	93·556
Cheltenham	3	Pakeha	93·552
Kaikoura	302	Kai	93·534
Uruti	300	Uruti	93·534
Tarurutangi	728	Champion	93·519
West Coast Farmers'	675	Silver Pine	93·508
Tariki	1818	Tariki	93·462
Norsewood	600	Norsewood	93·454
Tamaki	1356	Bell	93·435
New Zealand (Ngatea)	291	Anchor, &c.	93·434
Murchison	1888	Airship	93·410
Tikorangi	102	Shield	93·400
Sefton	28	Star	93·373
United	1296	Whariti	93·359
Arahura	1516	Arahura	93·355
Manutahi	495	Manutahi	93·326
Kairanga	1768	Longburn	93·312
East Tamaki	301	East Tamaki	93·293
Ruawai	66	Ruawai	93·288
North Taranaki	723	Flax	93·264
Taieri and Peninsula (Oamaru)	1234	Taieri and Peninsula	93·250
Mauriceville	14	Mauriceville	93·243
Omata	82	Omata	93·241
Ormondville	735	Ormondville	93·185
Kuku	905	Ohau	93·169
Caroline	236	Caroline	93·141
New Zealand (Waiuku)	111	Anchor, &c.	93·086
Farmers' Dairy Federation	165	Gore	93·068
Co-operative Dairy of Otago	266	Huia	93·063
Whakaronga	1709	Whakaronga	93·052
Stratford	68	Good Luck, &c.	93·026
Cambridge	1239	Cambridge	93·019
Kaipara	794	Poplar	93·007
Wellington Municipality	202	Rahui	93·007
		CHEESE-FACTORIES.	
Hopelands	1178	Hopelands	93·755
Little Akaloa	32	Little Akaloa	93·745
Milton	1030	Milton	93·742
Omimi	74	Omimi	93·738
Kaiparoro	619	Bruce	93·734
Dalefield	9	Dalefield	93·461
Tamaki	1463	Tamaki	93·431
Wellington Dairy Farmers'	252	Onward	93·314
Collingwood	1742	Collingwood	93·287
Carrington	621	Carrington	93·287
Waimana	1817	Waimana	93·269
Staveley	1719	Staveley	93·264
Woodville	1892	Woodville	93·190
Temuka (Co-op.)	207	Ohape	93·111
Rapanui	1714	Southern Grove	93·109
Pahia	707	Pahia	93·065
Tamaki	58	Tamaki	93·039
Paraparaumu	167	Pram	93·017
Momona	1010	Momona	93·017
Browns	925	Browns	93·015

SEASONAL NOTES.

THE FARM.

ROOT AND FORAGE CROPS.

DURING recent years there has been a slow but steady decline in the area devoted to root and green forage crops, and this decline is largely attributable to the rapid expansion of the practice of top-dressing grassland with phosphatic fertilizers. Top-dressing has been the means of greatly improving the amount and quality of the feed produced by pastures, and in dairying districts the conservation of some of the surplus summer production of grass as hay and ensilage for feeding during periods of grass-shortage has rendered less necessary the growing of roots and green forages for autumn and winter feeding.

Soft turnips, swedes, and rape are still, however, necessary grass-supplementary crops in the arable farming districts of New Zealand, where low summer rainfall and low winter temperatures are the limiting factors in the production of grass pastures. Also on many North Island dairy farms the pasture-land has not yet been brought to a sufficiently high state of fertility to allow of the annual grass-supplementary crops being entirely replaced by hay and ensilage. The successful adoption of really intensive grass-farming methods on dairy farms will depend on there being available a large reserve supply of grass ensilage and hay to tide the herd over any period of particularly poor grass-growth.

On many farms the growing of roots and green forage crops is a necessary step in the improvement of the pasture-land, and their production for some years will allow of a good reserve of hay and ensilage being accumulated prior to the adoption of more intensive grass-farming methods.

Land intended for root and forage crops should be brought to a good tilth before sowing and by " a good tilth " is meant a seed-bed that is clean, sweet, moist, fine, firm, and deep. The main points to be observed in ploughing the land for root and forage crops were outlined in last month's notes, and the tillage work during October and November should aim at securing a seed-bed that is fine from top to bottom, at preventing the loss of moisture, and at refirming the soil prior to sowing so as to restore the moisture connection with the sub soil and bring up supplies for the use of the seed and the young roots.

It is very important that the seed-bed should be fine from the top to the bottom. A superficial pulverization that leaves the lower part of the seed-bed cloddy is very unfavourable to crop-growth. Large clods in the lower layers of the soil prevent the rise of moisture, and when the clods break down, as they finally do, the soil often lacks the degree of firmness that is necessary for good growth. On heavy land it is necessary to use the spring-toothed cultivator to bring the clods to the surface, where they can be dealt with by the roller and disks. The cultivator, besides bringing the clods to the top, shakes

the fine soil to the bottom, where it will form a continuous layer with the unmoved subsoil through which moisture from the lower levels can reach the surface.

The main sowing of root and forage crops takes place in November, but when large areas are sown it is always advisable to sow in breaks, and in favourable districts the first break of soft turnips and rape can be sown towards the end of October. Mangolds are often sown in October, but in any year when that month is cold and wet the sowing should be delayed until November.

PASTURE MANAGEMENT.

As referred to in recent notes, much more intensive methods of farming grassland seem likely to be undertaken on dairy farms in the near future. Intensive grass-farming consists in close subdivision, regulated stocking, and heavy manuring. Grass is treated as a crop — the pasture being allowed to reach a height of 4 in. to 5 in., quickly grazed down, and then spelled till the next crop of young grass is ready. No definite rules can be laid down governing the exact stage at which pastures should be grazed by milking-cows. A good deal depends on the completeness with which the pasture was grazed and harrowed prior to shutting up. If the grazing was uneven the pasture may have a general growth of 2 in. to 3 in., while in parts it is 5 in. to 6 in. high, and when this is so it is best grazed at this stage before the higher growth gets rank.

The success of intensive manuring of grassland depends very largely on the completeness with which pastures are grazed and harrowed before being shut up. The milking-cows should be followed by young stock and horses, to graze the pasture down to a close, even sward. Where there are not sufficient young stock on the farm to clean up the growth after the milking-cows, it is possible to use the cows themselves to do the final grazing by allowing them to graze after each milking in a new pasture for one to two hours, and then moving them off into the pasture on which they have just finished the best grazing and using them to clean up the remaining growth. It is very necessary to closely graze the pastures prior to harrowing and shutting up if a good even growth is to be obtained.

Many dairy farms are not sufficiently subdivided to control the summer growth by grazing and by conserving some of the surplus growth as hay and ensilage, and in such cases the use of the mower is still necessary to keep the growth short. On many farms the mowing of the rank growth is left rather late, not being done till January or February. Early mowing is important, because the autumn growth of grass is thereby increased.

REPAIR OF IMPLEMENTS.

Ploughs on arable farms are in constant use from January to September, but after ploughing the land for spring- and summer-sown root and forage crops they are not used to any extent until December or January, when a start must be made on skim-ploughing grassland for autumn wheat or breaking up stubbles for autumn catch-crops. It is a good plan to always overhaul implements immediately after the seasonal work is finished, and when any faults that have manifested

themselves during work are fresh in mind. The system of lubrication should be overhauled, skeiths adjusted, and any other necessary repairs made.

Grass-mowers should be overhauled and put in readiness for cutting hay and ensilage in November and December. Worn ledger-plates should be renewed, broken knife sections replaced, and the fingers adjusted so that there is close contact between the knife sections and ledger-plates. One cause of bad cutting in mowers is that the knife does not centre properly. When the knife is at the end of its outward or inward stroke the knife section should lie in the centre of the fingers; if the sections do not centre the cut is ragged and the draught is increased. This defect is usually due to the pitman not being of correct length. Most metal pitmans allow of adjustment. Another cause of this defect is that the bar is out of alignment, which may have been caused by bending after striking some object or from continuously cutting round corners. Besides causing bad cutting, a disaligned bar means severe wear on the knife-head.

—*P. W. Smallfield, B.Ag., Fields Superintendent, Auckland.*

THE ORCHARD.

SEASONAL SPRAYING.

DURING the period following the publication of these notes spraying for the control of pests and diseases will be the main consideration of the orchardist, and until the fruit of all varieties is well formed the work must necessarily be very exacting. Special consideration must be given to each variety, according to the stage of development and its susceptibility to the diseases against which control measures are necessary. Later on, however, it is possible under normal conditions to adopt a combination spray which may serve all varieties. In the meantime the development of the different varieties must be watched closely, and sprays applied at the correct stages if the best results are to be expected.

One may often be guided by previous experience, and a well-kept spraying-log is a very necessary and useful part of an orchardist's equipment. Such details as dates of application, varieties sprayed, materials, strength of mixtures, stages of development, and weather conditions may be noted at the time, and, later, further notes on weather conditions immediately following, together with results, may be added. Often it is found necessary to repeat a spraying if rain follows immediately, and it is never safe to hold rigidly to a set programme. One must be guided by weather conditions, and extra spray applications should be wedged in if thought necessary.

It is usual to apply at least two fungicidal sprays on apples and pears prior to the blossoming-period. The second application, applied when the cluster buds are well expanded and showing some colour, usually consists of lime-sulphur, 1–40–50, on apples, and on some varieties of pears such as Winter Cole and Josephine. Other pear varieties would be better with a second application of bordeaux, 3–4–50. On certain varieties of apples which may have suffered on account of

powdery mildew, 8 lb. to 10 lb. of precipitated sulphur in addition to the lime-sulphur is advisable at this stage. In certain localities and under weather conditions favourable for the development of black-spot it may be necessary to apply on apples a second "pink" spray of lime-sulphur, 1–60.

This will carry one over till the next stage—"petal-fall." As this is a critical period in the development of black-spot, there should be no delay in applying a protective spray, when about 75 per cent. of the blossoms have fallen. On varieties of pears subject to black-spot, bordeaux, 3–4–50, should be continued. Other pear varieties may receive lime-sulphur, 1–80, at petal-fall. More consideration must now be given to the treatment of apples, having regard to the tenderness of the variety and the possible effect on the crop, at the same time guarding against attacks of black-spot. At the petal-fall or calyx stage, lime-sulphur with one of the precipitated sulphurs added is beneficial. However, on certain tender varieties, such as Cox's and Dunn's, it would be advisable to refrain from using lime-sulphur. Lime-sulphur, 1–100, with the addition of 8 lb. precipitated sulphur to the 100 gallons, is a suitable combination at this stage. The precipitated sulphur, if used alone, should be applied at a strength of at least 10 lb. to the 100 gallons.

Insect pests must also receive consideration. The use of lime-sulphur may keep in check such pests as red mite and scale insects. However, poison sprays for codlin-moth grubs and leaf-roller caterpillars must be added to the petal-fall sprays on apples and pears. Arsenate of lead, at the rate of 1¾ lb. powder or 3 lb. paste to 100 gallons, must therefore be added. Attacks of apple leaf-hopper, which causes as much damage to foliage as attacks of red mite, must be guarded against. These insects must be fought while in the nymph stage, as it is impossible to control hopper by spraying when they have become winged. A close watch must therefore be kept, and Black Leaf 40, 1–800, added if the hopper is present. It is usual to add the milk from about equal weight of fresh burnt lime to that of arsenate of lead, after diluting the arsenate with water to prevent injury from any free arsenic which may be present.

The "dry-mix" sulphur spray is favoured by a number of orchardists, and may be used as a substitute where precipitated sulphur is mentioned. It is prepared as follows: Ingredients—16 lb. fine powdered sulphur, 5 lb. fresh rock lime, ½ lb. casein. Wet the casein and dissolve it with ¼ pint of caustic soda solution (the stock caustic-soda solution is made by dissolving 1 lb. caustic soda in 1 gallon water); stir well and bring the mixture to a milk and make up to 1 gallon with water; sift the sulphur, and make it into a paste by adding the gallon of dissolved casein and as much more water as is necessary to bring it into the consistency of a creamy paste; slake the lime, and dilute the milk to 10 gallons with water; strain it into the spray tank; start the agitator and add the creamed sulphur, and finally make the spray up to 100 gallons with water.

Stone-fruit will require attention, chiefly for the control of brown-rot. The dry-mix sulphur has proved a decided control for this disease. Some growers favour lime-sulphur combined with precipitated sulphur. The following formula may be used: lime-sulphur, 1–130; precipitated sulphur, 6 lb.

ORCHARD SANITATION.

Orchard sanitation plays quite an important part in disease-control. Prunings should be burned at the end of the season. Old picking-boxes which have held moth-infected apples and pears are often left about packing-sheds and orchard, and are invariably found to contain cocoons. Infected fruit should be destroyed at the time of picking. However, such boxes as mentioned should be destroyed or sterilized.

MANURING AND CULTIVATION.

It is essential that orchard land should be brought into real good tilth early, as delays and the possibility of dry weather setting in before such work is completed will render attempts at reducing the land to a desirable state almost hopeless. Poor cultivation is soon reflected in the size and condition of fruit and in weakened foliage. Most orchards benefit by some form of manuring, and annual applications of fertilizers with occasional liming is an important factor in maintaining profitable production. In most cases artificial fertilizers will have already been applied. However, quick-acting phosphates may still be given with a good chance of securing the full benefit from their application. From 4 lb. to 6 lb. of high-grade superphosphate and 1 lb. to 1½ lb. sulphate of ammonia may still be applied. It may be noted here in connection with manuring that no soil analysis can give more than an indication as to the requirements in the way of manure. These can be better determined by experiment.

GRAFTS AND BUDS.

Trees will still be in a good condition for grafting, and the work should now be pushed on without delay and completed before the middle of October, before scions become too forward. Clean cutting, good binding, and exclusion of air about the union are essential points if success is to be obtained. Binding may be done with raffia or with strips of waxed cloth. In the former case grafting-wax is smeared round the graft. The popular method of reworking old stocks is by rind-grafting. The scion, consisting of a length of last year's growth, preferably the thickness of a lead-pencil, and shortened to three buds, is cut wedge-shaped; a short cut is made vertically through the bark of the stock, and the bark on one side of this cut is lifted carefully. The wedge-shaped scion is pressed down beneath the raised bark of the stock. One edge of the wedge portion of the scion is pared off while being prepared, and this edge will lie against the unlifted edge of bark on the stock when the scion is pushed home.

Stocks which have been budded, if not already attended to, should be cut down to above the bud, so as to force the dormant bud into strong growth. The usual practice is to cut within 2 in. of the bud and to remove the remaining stub about midsummer. The tender shoots arising from buds may require securing to sticks.

FRUIT IN COOL STORE.

Fruit in cool store should now be drawn on in quantity, and fruit which is intended for very long storage should be examined periodically for condition. Large-size Sturmers should be marketed early.

—*N. J. Adamson, Orchard Instructor, Hastings.*

Citrus-culture.

The principal work of the coming month will consist in pruning all trees and cultivation of the land. There will be found throughout the trees may fruit laterals which have become worn out, and quite a number of dead snags resulting from fruit twigs and laterals dying back. This season is a most opportune one to remove all such wood and cut back exhausted laterals to a sound bud, which will give replacement with newer laterals of a fruitful type. Particular attention should be given to the inside of the tree, for unless growths in these parts are well regulated by spacing and replacement a large proportion of the fruiting-area may be lost. Growths of a very succulent nature, and misplaced leaders or branches, should also be removed.

With renewed activity of the tree during spring good wood-growth may be expected, but it should be remembered that root-action is also active and extending at the same time, consequently cultivation of the soil should be attended to. Where this is neglected the habit of citrus-trees to form fibrous roots near the surface is encouraged, and such roots are of little value later in the season, being exposed to higher soil-temperatures and subject to excessive dryness. The trees consequently suffer when they most require moisture, making as they do their maximum demand on the soil during the period of minimum rainfall. It is not sufficient to cultivate deeper later on, as by so doing surface roots made early are destroyed. The aim should be to cultivate deeply (4 in. at least), digging right up to the tree, and continuous cultivation of this surface soil will confine the roots to a lower and more appropriate level, while at the same time conserving all possible moisture.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

END OF THE HATCHING-SEASON.

THE end of this season's period for hatching out chicks is now near at hand, and for this reason no further time should be lost in placing the last eggs into the incubator or under the natural mother. The late-hatched chick always commences its life under a severe handicap as compared with the early-hatched bird, which develops as the days lengthen and thereby meets with those favourable conditions for promoting rapid growth and sound development. The drawbacks to late hatching are many, the chief being that the chickens have the midsummer heat to contend with, and are then subjected to the cold weather often experienced in the late autumn, before they are properly developed. The drawbacks to late hatching may be largely counteracted by placing the little birds under the very best conditions possible, such as in an orchard where good shade, shelter, and fresh ground are available.

The chickens should be encouraged in every way to develop without check. Only good wholesome grain food should be supplied. Green food is of special importance, and should be fed in abundance. Finely-cut succulent grass, lucerne, clover, watercress, lettuce, silver-beet leaves, or even young cabbage-leaves provide suitable green material for growing chickens. A constant supply of grit, charcoal, and clean

water should be kept before the young birds. Above all, the quarters should be maintained in a thoroughly sanitary state to ensure against insect pests making their appearance.

NON-ABSORPTION OF YOLK IN INCUBATED CHICKS.

It is one thing to hatch a chick artificially and another thing to rear it. A common mistake is to think that because chicks hatch out well and give every evidence of being perfect specimens it follows they will be reared successfully. For example, much mortality takes place in chicks when from three to six weeks old, due to the yolk which is drawn into the chicken's body just before it leaves the shell failing to digest. In such cases the yolk, instead of being gradually absorbed to provide nourishment for the chick during the first four days, as nature intended, gets into a more or less hardened state, when death sooner or later takes place—and this quite regardless of the birds being properly fed and managed. When this condition is disclosed by a post-mortem examination the cause of death will be made apparent. It is generally believed that failure of the yolk to become assimilated is due to feeding the chicks too soon after hatching, or to overfeeding during the first few days. It is also often considered that breeding from overfat hens is responsible. While these factors may have some bearing on the matter, experience goes to show that this trouble is due more to improper incubation than to any other cause. This is confirmed to a great extent by the fact that the trouble is seldom found in chicks that have been hatched by the natural mother. There it will be found (except, perhaps, in very isolated cases) that the yolk is in a more or less liquid state, which enables it to run freely and become easily assimilated. With incubator-hatched chicks the hardened yolk and its bad effect on the young bird is undoubtedly chiefly caused by having the temperature too high during the whole or a part of the incubating-period—half-baking, as it were, the yolk and rendering it incapable of absorption. I would again emphasize the advisability of opening up any chick that dies, in order to discover if possible the cause of death, and gain knowledge regarding preventive measures.

OVERSUPPLY OF MEAT-SUBSTITUTES.

While blood-meal and meat-meal are excellent substitutes for boiled meat for the purpose of promoting egg-production, there is a danger in overfeeding fowls with these concentrated foods. They do not require the same forcing-food in the present natural laying season as in winter, when egg-production is more or less artificially forced. The proportion of such materials as blood-meal and meat-meal should be reduced now, especially where the birds have a free range with opportunity, especially after rain, of picking up insects, worms, &c. In forcing egg-production animal food in some form is necessary, but in the natural laying season only a minimum quantity is required. If oversupplied then ovarian troubles such as protrusion of the oviduct and the production of double-yoked and shell-less eggs are apt to result.

DUCK-REARING.

October is a good period for hatching out ducklings for the renewal of stock. Under proper management ducklings rapidly develop, and

may therefore be hatched to advantage much later than chickens. Indian Runner ducks hatched out in October may be expected to lay during the next dear-egg season. Ducklings can be hatched by artificial means in a somewhat similar manner to that employed for chickens. The temperature during the period of incubation, at the level of the top of the eggs on the tray, should be 102° F. for the first week; from this on to the pipping stage 103°; and 104° when hatching. If the correct degree of temperature is maintained the ducklings will commence to pip on the twenty-sixth day, and hatch out on the twenty-eighth. Beware of the common mistake of trying to help the little birds out of the shell, until they have been given their full time to hatch. When once the eggs have commenced to pip the door of the incubator should not be opened until the hatch is practically cleaned up.

One of the secrets in hatching duck-eggs is the application of moisture. The best way of applying this is to spray water at a temperature of 103° with the mouth on the eggs every morning after the fourteenth day. Do this after turning, and immediately place the eggs back in the machine. Do not cool after spraying. Spray in the morning and cool at night.

Ducklings are much easier to rear than chickens. If success is to be attained, however, several points must be strictly observed. The young birds should not be fed for thirty-six hours to forty-eight hours after hatching. In the first week the food may consist of equal parts of scalded bran and pollard to which is added a small quantity of oatmeal and fine grit, not sand. Feed four times a day a quantity that the birds will pick up clean in about ten minutes. When the ducklings are about a week old the grit need not be mixed with the food, but it should be available to them in a shallow receptacle so that they can help themselves. As the ducklings grow older the oatmeal can be eliminated from the ration and maize-meal substituted. Well-boiled wheat makes a splendid change for growing ducklings. Finely cut green food, such as lettuce or young tender grass, should be fed separately after the first week, while a little boiled minced meat should be given and increased by degrees as the ducklings develop.

Water should be given with the first meal, and from then onwards it should be left in reach of the birds, both day and night. It is of the greatest importance that they be not given water after a long fast until they have received a meal. Even then it is a wise course to provide water with the chill taken off. When ducklings are given a cold drink before food, and especially if they have been confined in a brooder without food, they are almost sure to suffer from staggers, followed by heavy mortality. Ducklings thus affected give every indication of being in a fit, falling on their backs with eyes twitching, and presenting a generally distressed appearance. They will sometimes behave in a similar manner, and with serious losses, when enclosed in an overhot, badly-ventilated brooder. It should be always remembered that provision for an ample supply of fresh air at all times is one of the chief secrets in artificially rearing ducklings.

Although ducks are water-fowl, it is imperative for old or young birds that their sleeping-quarters be maintained in the driest possible condition, or leg-weakness and other troubles will result. After, say, three to four days the water-vessels should be placed in the

brooder-run, and well away from the sleeping-quarters, as a means of minimizing the wetting of the latter. At this stage the vessels should be of sufficient depth for the birds to wash off any food from their nostrils, and at the same time give them a good blow-out. If the nostrils are allowed to clog the eyes become plastered, while lameness, weak back, and an unthrifty condition soon sets in. It is important that young ducklings be provided with good shade during hot weather, as they are prone to sunstroke.

As is the case with chickens, young ducklings should be marked for future age-determination. The best way of doing this is to take a V-shaped piece out of the edge of the web of the foot. This should be done with a very sharp pen-knife, the foot of the duckling being held firmly on a piece of solid smooth board during the operation. Ducklings can be marked when leaving the incubator.

WHITE INDIAN RUNNER DUCKS.

Last year Mr. A. Wood, Grey Lynn, Auckland, the noted breeder of White Indian Runner Ducks (whose pen of three birds laid 989 eggs for one year, and team of six birds 1,891 eggs for the same period, at the Auckland egg-laying test of 1926–27) generously presented to the Department of Agriculture several sittings of eggs from his special strain. The eggs were hatched out at the Department's Wallaceville Poultry Station, with the result that the station is now possessed of a flock of high-class birds. They not only possess laying-qualities, but are also generally good types of their breed—beauty and usefulness being thus happily combined. Such stock should specially appeal to farmers. A limited number of sittings from this high-class stock are now available for disposal at 15s. a dozen, postage free. Applications should be made to the Poultry Overseer, Wallaceville Veterinary Laboratory (Private Bag), Wellington.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

SPRING FEEDING.

A CONSTANT watch should be kept on the stores in the hives. Usually at this period there is a steady drain on the food-supply to meet the incessant demand for brood-rearing. If an examination of the hives was carried out as advised in my July and August notes, then the losses attendant upon spring starvation will have been avoided ; but it is not wise to neglect to feed where stores are now short, as the spring is the most critical period for the beekeeper. The weather conditions are not always favourable for the bees to work the early spring blossoms, and in populous colonies the food-supply should be augmented, but only where there is a noticeable shortage. If there is a good queen in the hive she will usually begin laying as fast as weather conditions will permit, and it is a mistake to start feeding unless stores are very short, as it stimulates brood-rearing, and when started must be carried on until a natural flow sets in from the fields.

Abundance of stores is certainly required at this season, and if the beekeeper finds that additional food is required it can be supplied in the form of combs of honey or as a syrup. The feeding of combs of honey should not be practised unless the beekeeper is sure that his apiary is free from disease, as there is always danger of spreading disease by this method. No better substitute for honey has been found than cane-sugar, and it is far safer to use it at all times if the beekeeper is not satisfied as to the health condition of his apiary. Honey from an unknown source should never be fed. There are many feeders on the market. The division-board feeder is the best to use at this season, as it will serve the double purpose of feeder and division-board in cases where the colony is not strong enough to occupy all the frames in the hive.

THE WATER-SUPPLY.

In the spring months, when brood-rearing is at its height, bees require a good supply of clean water in the apiary. If this is not provided they are apt to become a source of annoyance at drinking-troughs and by congregating round domestic supplies. Brood requires a great deal of water in addition to pollen and honey. The amount depends largely on how much brood-rearing is going on, and to what extent nectar is coming in from the fields. If water is not close at hand many bees are lost in trying to obtain it, more especially as the weather is often changeable and boisterous in the spring.

Many simple contrivances can be made to supply water. "Simplicity" feeders make excellent vessels for the purpose, but they require to be filled frequently. To start the bees taking water from any particular place it is a good plan to slightly sweeten the first water given.

UNITING COLONIES.

As advised last month, if weak colonies are found they should be united with stronger colonies. It is economy not to attempt to build them up. Place the weak colonies on the stronger colonies. It is well to remember that this is an important point in spring management.

CLEANING THE HIVES.

It is well to now take advantage of any settled weather to spring-clean the hives. Lift the hive off the bottom-board, and clean off the dead bees and other waste matter. The simplest way is to take a spare bottom-board, remove the complete hive, place a clean board on the stand, and then return the hive to its place. The operation may be carried out quickly, and without disturbing the bees. Scrape the debris from the old board into a tin and destroy by fire.

FOUL-BROOD DISEASE.

At all times when examining the combs a strict watch should be kept for symptoms of foul-brood. Beekeepers should never lose an opportunity of acquainting themselves with this disease in all its stages. At this season if isolated capped cells are discovered in frames which contain no other brood, these should be treated as suspect and subjected to the test for foul-brood. If on opening a cell, when a sharp-pointed piece of stick is inserted, the dead imago can be lifted out complete in form,

the beekeeper may conclude that if dry it is a case of starvation, and if moist a case of chilled brood. If, however, the contents of the cell adhere to the point of the stick in a ropy ill-smelling mass it may be concluded that the hive is diseased. There is perhaps no surer indication of the presence of foul-brood in the hive than the objectionable smell of the decayed larvæ. Beekeepers who once recognize this odour will have no difficulty in detecting the disease in that stage. The last and most difficult form of foul-brood is the dry stage, and in this form it has baffled beekeepers of long standing. Only a careful examination can reveal its presence. The diseased larva, having dried to a scale, adheres to the lower side of the cell, and can be removed by scraping with a sharp-pointed instrument. If the aforesaid isolated capped cells on being opened appear at the first glance to be empty, they will almost invariably yield a scale if examined, and the hive should be marked for treatment.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the coming month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost fatal to treat the bees in October; in others where right conditions prevail it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding. For full details regarding American foul-brood and its treatment see Bulletin No. 119, obtainable free on application from the Publisher, Department of Agriculture, Wellington, or from the district Apiary Instructor.

REGISTRATION OF APIARIES.

A reminder is necessary in the case of beekeepers who have failed to make application for the registration of their apiaries as provided by section 5 of the Apiaries Act, 1927. Prior to the present Act coming into force registration was required every third year. However, under the new Act registration remains operative as long as the same beekeeper occupies the same premises and continues to keep bees thereon. As the matter now stands every owner of an unregistered apiary is liable to prosecution without warning, and upon conviction is liable to a penalty not exceeding £20. Application for registration is to be made to the Director of the Horticulture Division, Department of Agriculture, Wellington. Registration is free, and on application being made in respect to any apiary there is issued, without charge to the person by whom the application for registration was made, a certificate. Any such certificate is *prima facie* evidence of the registration of the apiary to which it relates.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE MARKET-GARDEN.

THE half-hardy annual vegetables now demand the consideration of the planter; they include dwarf and runner beans, marrows, and pumpkins. These are very important crops, as they not only make excellent provisions during the summer-time, but they have first-rate storing-qualities, and require only the simplest accommodation to keep them throughout the winter months. Land from which spring cabbage and cauliflower are cleared will become available for these plantings towards the end of the month. The planting and sowing of all main crops, including the popular beetroot, should now be completed. The tomato crop outside is inclined to take precedence, but the useful lettuce is becoming increasingly popular, and on suitable land it will probably pay to start a crop now for the Christmas trade. Spinach is also a favourite delicacy, and a further sowing should now be considered. Feed the asparagus crop now and during the summer months by applying 2 cwt. to 3 cwt. of salt per acre per month, also the same quantity of fowl-manure desiccated and ground.

For planting out during December and January on land from which peas, potatoes, and other early crops have been cleared, sow towards the end of the month seed-beds of celery, autumn cauliflower, broccoli, Savoy cabbage, and leeks. This is a very important section, and where the land is suitable it will probably pay to give it careful consideration. For large crops sow the seed thinly in drills 1 ft. apart, and install the overhead watering system. Celery-plants grow best under moist shaded conditions, and brush or lath screens or a cheesecloth cover will be useful in helping to provide these.

TOMATOES, ETC.

The tomato is a half-hardy plant of the same natural order and geographical origin as tobacco and its management in many ways is very similar. For outdoor planting the same hardening-off of the plants in frames should be carefully carried out. Before removing the plants from the boxes it is usually a wise precaution to give them a good bordeaux spray, carefully covering the stems and underside of the leaves. Where the market demand is prolonged almost into the winter, it is customary to make a late planting in December. For such a purpose a further sowing should now be made; it is unsatisfactory to retard plants for the purpose; plants that have received such a check are usually quite unsuitable for commercial cropping.

The warmer weather of October creates difficulties in the tomato crop growing under glass where ventilators are inadequate or lack attention. Leaf-mould (*Cladosporium*) now makes its appearance in such houses, and in the warmer districts is the cause of great losses. Strange to say, growers will spend money freely on all kinds of suggested remedies before they provide the increased ventilating-area required. A high temperature and close atmosphere suits some plants, but not the tomato, the foliage of which, if subjected to such conditions for any length of time, becomes soft and inefficient through the attacks of the fungus parasite. The ventilation of the glasshouse at this season, with rising outside temperatures and more than half the interior space

filled with foliage, is now at its most difficult and important stage; inadequate or excessive ventilation will seriously interfere with the valuable early crop. Under these conditions more water will generally be required by the plants, but chilling should still be carefully avoided by arranging to do the watering during the mild warmer weather.

Egg-plants and peppers are rather more tender than the average half-hardy plants. They should be hardened and planted out in the open, in stages a fortnight later than others. They should then be quite satisfactory in sheltered localities where tomatoes crop well.

BERRY FRUITS.

Brakes of berry fruits should be hoed occasionally in fine weather to keep the weeds down, and superfluous canes of raspberries and loganberries should be removed. Where hand-hoes are used much damage is often done by striking the butts of the bushes beneath the surface with the hoe. In the cuts so inflicted fungous growth is often established, and many plants are lost. On light land berry crops are sometimes a failure in a dry season. This could be overcome if some form of irrigation were arranged for use in an emergency.

MELONS AND CUCUMBERS.

Some very fine water and rock melons are grown in this country, and the demand is far from being supplied. Those growers who have warm, rich, friable soils that are moist could well give these crops more attention. Plants can be raised in paper pots on old hot-beds that have been used for tomatoes, or seeds may be planted out in the field 4 ft. apart and 6 ft. between the rows. Sometimes the seeds are sown in a slight depression and covered with a sheet of glass, but a cheaper method is to use a 16 in. square of waxed paper that is held up off the ground with a hoop of galvanized-iron wire, the edges of the paper being held in position with a little soil. When the plants are up and the weather mild the paper is lifted up on the lee side, and when the plant is sufficiently hardened it can be removed altogether and the papers burnt, while the wire hoops may be stored for future use.

Ridge cucumbers may be grown in a similar manner. In some districts sowing could be done towards the end of October.

THE TOBACCO CROP.

Preparations for planting out this crop in the field should be completed during October. Instructions for this work and other operations will be found in a special article on "Tobacco-culture" printed elsewhere in this issue of the *Journal*, which may take the place of the usual notes on the present occasion.

SPRING-TIME GARDEN FOES.

The combat with pests in the ground, on the surface, and in the air, that frequently causes the amateur to despair because the attack is unexpected, is usually brought to a successful issue by the experienced gardener who is observant and knows their ways. Common pests that feed upon roots and stunt the growth of plants in the ground are leather-jackets, the larvæ of crane-flies that love damp places; wireworms that

are the younger generation of click beetles; millipedes that are so often confounded with the friendly centipede which is carnivorous; and—perhaps the most common and difficult—the "grass-grub," the larva of the chafer beetle. Most dangerous on the surface of the ground at this time are the surface caterpillars or cutworms, the larvæ of various moths, which appear to be the embodiment of malignant mischief, as they cut young plants off neatly at the surface of the ground during the night, and just leave them where they fall. The insatiable appetite of slugs and snails is more honest and understandable. From the air the foes are various birds which in spring favour a salad diet combined with tender swelling seeds about to sprout. Successful cropping often depends on a good knowledge of the habits of these pests so that they may be avoided or dealt with effectually.

For subterranean pests fumigants may be used, such as carbon bisulphide, which can be supplied with a convenient injector; but such remedies are expensive and used only in special cases. Early and thorough cultivation affords a large measure of success, by disturbing the creatures when pupating, besides exposing others to their enemies—the birds—which eagerly search new-turned ground, especially during the winter. On some classes of heavy land even a fairly long fallow is a paying method. One of the best means of defence is a heavy dressing of kainit during the winter, followed by generous but discriminate use of nitrate of soda in the spring, which not only discourages the pests, but stimulates plant-growth, and so makes good the loss of roots.

Of pests that range the surface of the ground, the cutworm is readily checked by early and thorough cultivation of the land, and the combat is entirely successful if poisoned bran is broadcast towards the end of an afternoon, shortly before young plants are set out for the season. This bait is also successful in controlling slugs and snails, while another effective dressing for the two last-mentioned is powdered alum, alone or mixed with twice its weight of fresh slaked lime. But economy and results depend upon an intelligent use being made of these methods. They should be applied to plants subject to attack when observation has discovered the pest to be present; that is an economy. Furthermore, the application should be made just before or after the pest has emerged from its daytime hiding-place, according to the remedy used.

The bird pest is a very ancient trouble, but it is still the subject of correspondence with sufferers. The red-lead or kerosene treatment of seeds that are regarded as favourite bird-food is well known and efficient. For the protection of young seedling plants a dusting of soot or lime, or a chemical spray of lime-sulphur or bordeaux, will make the salad distasteful, and drive them away to dine on the crop of some gardener who is less attentive.

—*W. C. Hyde, Horticulturist, Wellington.*

Te Kauwhata Wattle Plantation.—During the last financial year 200 tons of green bark were harvested from the black-wattle plantation at Te Kauwhata Horticultural Station for sale to tanneries. A considerable amount of waste timber was sold as firewood, and timber-cutting on a royalty basis was continued. Gross revenue from the plantation amounted to £1,620.

WEATHER RECORDS: AUGUST, 1928.

Dominion Meteorological Office.

GENERAL NOTES.

August was, on the whole, a satisfactory month as regards rainfall, especially in view of the distribution during the preceding months. In most of the Auckland Province, where there was little need for it, the rain was below normal. In Nelson, and parts of Otago and Southland, too, there was a deficiency, and good rains will be needed soon in these districts, especially in the first one, if the season is to commence well. Elsewhere, registrations were mainly above the average, and much good will be done.

Most districts experienced remarkably uniform temperatures during the month, and the absence of extreme cold gave an effect of mildness even where the mean temperature was below the average. Growth has, on the whole, been good, and, although there is still some shortage of feed in some of the parts which experienced a very dry summer, conditions generally are favourable and stock and crops are doing well.

The month began with a continuance of the fine weather which had prevailed over the greater part of July. The rain-producing disturbances were of slight intensity in the New Zealand area until the 13th. A particularly fine spell was experienced from the 8th to the 11th, during which period the weather was controlled by a very intense anticyclone.

On the 12th the western districts were affected by a depression in the Tasman Sea which gradually moved eastward. On the 14th the trough of the depression lay across the Dominion, and a cyclone developed in its northern portion. The centre of the cyclone crossed the North Island from northern Taranaki to Hawke's Bay on the 15th, and then passed away eastward on the 16th. There were north-westerly gales in Cook Strait on the 13th, while on the 15th there were gales, generally from a southerly direction, at many places. At Wellington the southerlies were especially severe, and, combined with a high tide, caused much damage to the railway-line between Kaiwarra and Petone; shipping about Cook Strait was delayed, and minor damage of various kinds was done about the city. The period from the morning of the 13th to that of the 16th was a very wet one. The rain was general and there were many heavy falls.

Another storm of somewhat similar type passed during the 20th. There were northerly gales in Cook Strait during its approach, and fairly general southerly gales over the North Island on the 21st after the centre had passed. Again there was almost general rain. Gales and general rains were associated also with an intense southern depression which passed during the 23rd and 24th.

At the end of the month occurred the fourth and last of the important disturbances. This was an intense southern depression of the inverted-V type. Depressions of this type are usually followed by one or more secondaries, but there were none in this instance. The barometer fell rapidly to a minimum, and then commenced to rise again immediately with even greater rapidity. There were northerly gales during the 30th over much of the South Island, which changed suddenly during the evening to southerlies. The drop in temperature was very marked, and snow fell thickly on all the ranges at least as far north as Wellington Province. In South Canterbury and parts of Otago and Southland the snow reached the low levels, being particularly heavy in South Canterbury. Near Wellington it was low down on the Orongorongos and other nearby hills. The 31st was a brilliantly fine day over most of the area which received the snowfall, and there was a rapid thaw; very little loss of stock therefore resulted in the high country. Apart from the snow, there was fairly general rain in connection with this storm also.

—*Edward Kidson, Director of Meteorological Services, Wellington.*

RAINFALL FOR AUGUST, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
	North Island.				
		In.		In.	In.
1	Kaitaia	3·82	13	0·93	5·10
2	Russell	2·51	8	0·73	5·55
3	Whangarei	4·17	18	1·96	6·90
4	Auckland	3·34	24	0·78	4·19
5	Hamilton	2·52	15	0·53	4·02
6	Kawhia	3·09	13	0·66	4·54
7	New Plymouth	6·63	19	2·53	5·33
8	Riversdale, Inglewood	9·98	17	4·36	8·65
9	Whangamomona	5·55	11	1·26	5·83
10	Eltham	7·60	18	2·12	3·82
11	Tairua	2·80	15	1·12	6·33
12	Tauranga	1·54	12	0·31	4·08
13	Maraehako Station, Opotiki	5·58	13	2·36	5·20
14	Gisborne	4·95	14	1·42	4·55
15	Taupo	2·29	7	0·60	4·06
16	Napier	4·65	16	1·56	3·57
17	Maraekakaho Stn., Hastings	3·92	20	1·30	3·31
18	Taihape	3·30	16	0·47	2·73
19	Masterton	5·50	17	0·97	3·33
20	Patea	5·43	11	1·25	3·50
21	Wanganui	2·89	7	0·93	2·73
22	Foxton	2·76	9	0·90	2·89
23	Wellington (Karori Reservoir)	10·92	18	2·77	3·97
	South Island.				
24	Westport	7·08	19	1·46	6·27
25	Greymouth	8·04	19	1·71	7·53
26	Hokitika	12·44	19	2·14	9·34
27	Ross	16·42	15	4·51	10·40
28	Arthur's Pass	9·27	8	3·42	12·78
29	Okuru, Westland	6·31	7	2·16	11·46
30	Collingwood	5·97	16	1·76	6·96
31	Nelson	2·93	10	0·94	3·02
32	Spring Creek, Blenheim	2·80	11	0·80	2·73
33	Tophouse	3·65	7	1·85	4·64
34	Hanmer Springs	7·30	18	1·18	2·52
35	Highfield, Waiau	4·93	10	1·00	2·26
36	Gore Bay	6·28	9	2·80	2·12
37	Christchurch	1·83	12	0·66	1·83
38	Timaru	2·06	10	0·60	1·41
39	Lambrook Station, Fairlie	2·16	8	0·96	1·43
40	Benmore Station, Clearburn	3·63	9	1·46	1·45
41	Oamaru	1·58	9	0·53	1·71
42	Queenstown	2·30	7	0·83	1·93
43	Clyde	0·88	5	0·22	0·80
44	Dunedin	1·47	15	0·47	3·14
45	Wendon	1·60	8	0·44	2·26
46	Gore	1·21	11	0·27	2·31
47	Invercargill	2·48	19	0·36	3·31
48	Puysegur Point	8·96	21	1·12	7·20
49	Half-moon Bay, Stewart Is.	5·07	20	0·87	4·35

CERTIFICATION OF SEED POTATOES.

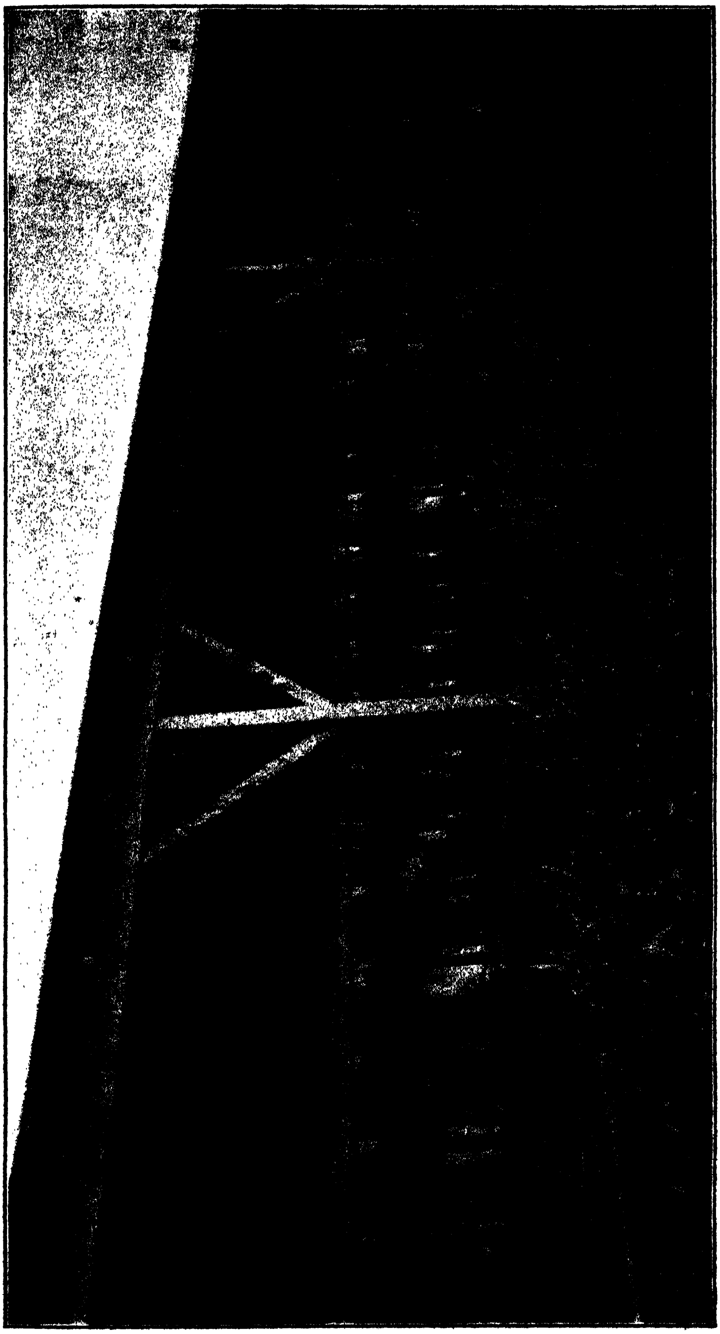
FINAL CERTIFICATES ISSUED IN CANTERBURY.

FOLLOWING is a list (up to 3rd September) of growers, who have been issued with final certificates by the Department of Agriculture under the system of Government certification of seed potatoes issued last season :—

		Acreage.
	Dakota.	
F. W. Carpenter	Prebbleton	19
J. Carr	Mount Hutt Rural, Methven	1
W. J. Crozier	Mount Hutt Rural, Rakaia	30
G. Hurst	Overdale P.O., Rakaia	4
W. McPhail	Mitcham, Mount Hutt Rural, Rakaia	13
C. E. Walker, jun.	West Melton R.M.D.	2
	Robin Adair.	
Muff Bros.	Orari	4
	Early Regent.	
W. Eder	Sefton R.M.D.	35
	Bresee's Prolific.	
J. Boag	Middlerigg, Brookside	2
F. W. Carpenter	Prebbleton	30
	Aucklander Short-top.	
F. Brundell	Camside, Kaiapoi	5
S. G. McCullough	Rangitira Valley, Temuka	3
W. E. Martin	Kaiapoi R.M.D.	9
A. J. Rich	Kaiapoi R.M.D.	10
	Aucklander Tall-top.	
J. Bailey	Kaiapoi R.M.D.	6
J. D. McMullan	Elmwood, Kaiapoi	8
A. J. Rich	Kaiapoi R.M.D.	5
	Arran Chief.	
A. Mortland	Templeton	10
F. A. Rollinson & Sons	Studholme Junction	20
F. Saunders	Studholme Junction	4
	Up-to-Date.	
C. E. Walker	Courtenay R.M., West Melton	6
F. Westaway	Courtenay R.M.D.	4

FERTILIZER IMPORTATIONS: JUNE QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the three months ended 30th June, 1928 :—*Sulphate of Ammonia:* Australia, 139 tons; United States of America, 125 tons. *Calcium Cyanamide:* Belgium, 2 tons. *Basic Slag:* United Kingdom, 6,025 tons; Belgium, 28,853 tons; France, 1,068 tons; Germany, 11,715 tons. *Bonedust:* India, 29 tons. *Rock Phosphate:* Nauru, 40,514 tons; Makatea, 3,987 tons. *Phosphates (other):* Morocco, 7,752 tons. *Superphosphate:* Belgium, 250 tons. *Kainit:* France, 114 tons; Germany, 90 tons. *Muriate of Potash:* France, 5 tons; Germany, 2 tons. *Sulphate of Potash:* France, 166 tons; Germany 166 tons. *Potash (other):* France, 2,254 tons; Germany, 859 tons. *Sulphate of Iron:* Australia, 11 tons. *Other Manures:* Australia, 1 ton; Belgium, 20 tons; Germany, 18 tons; United States of America, 5 tons.



[Photo by H. Drake.

CALF-FEEDING TIME AT RUAKURA STATE FARM.

The structure contains forty bails.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

EFFECT OF RAGWORT IN SILAGE.

B.R.H., Otorohanga :—

Could you please tell me the effect of ragwort in silage on dairy stock. This farm has a lot of ragwort, and I am told that it is very dangerous in hay, so wonder if it would be the same in silage.

The Live-stock Division :—

It is not known that the processes of fermentation which silage undergoes will destroy the toxic principles of ragwort, but, so long as the quantity is not excessively large, the ragwort would probably do no harm, because it would be so diluted that stock fed on the ensilage would receive only quite small amounts. We do not advocate making ensilage if one of the principal ingredients is to be ragwort. A better practice is to keep the weed in check by grazing with sheep, or by other recognized methods.

NON-MATURING FIGS.

" SUBSCRIBER," Masterton :—

I have a fig-tree, about ten years old and well grown, which bears a heavy crop of fruit; but when about half-grown the fruit begins to drop off, and never any of it reaches ripening stage. Can you suggest a cause or remedy ?

The Horticulture Division :—

The variety of fig you are growing is evidently unsuitable for your district. Very possibly the fruit may mature if it were fertilized with pollen from the wild Capri variety, but a special insect is required that has not yet been successfully introduced into New Zealand. However, there are satisfactory varieties that may be grown here without such cross-pollination.

BEARING TROUBLE IN PREGNANT EWES.

R.C.H., Mangaweka :—

We are losing several ewes through the bearings coming out. Could you tell us what is the cause of this, and also give methods of preventive and remedial treatment.

The Live-stock Division :—

The condition in ewes commonly known as " bearing trouble " (extrusion of the vagina) is known to be induced by what might be termed a plethoric condition of the animal. It is seen more commonly in seasons when feed is good, when as a consequence the ewes do not get sufficient exercise in travelling for feed. The result is the ewe becomes sluggish, suffers from fatty infiltration of the liver, and urination is infrequent, causing distension of the bladder—conditions which lead up to extrusion of the vagina. In nearly all cases it is observed in ewes carrying twin lambs. Preventive treatment lies in enforcing exercise on the ewes by frequently changing them daily during the fortnight preceding lambing. If possible the change should be on to barer feed; but rousing up of the ewes, and keeping them on the move a few times daily, has the effect of stopping the trouble. Regarding treatment of individual cases: if seen early, the bearing can be successfully returned. The procedure is as follows: The operator washes his hands and arms in an antiseptic and then oils them. The ewe is placed on her side, the extruded membrane carefully washed with warm water which has been

previously boiled, and is slowly returned by the hand into the passage, followed up by the arm, which is kept there until warmth is restored. A few stitches are then inserted across the lips of the part, and the ewe kept from movement for a time. A dose of two teaspoonfuls of laudanum in a little gruel given to the ewe helps to prevent further straining. Treatment of the condition is, however, frequently difficult and disappointing. If the parts are swollen and congested it is very often hopeless. Prevention is the main objective.

BROKEN CROCKERY AND GLASS FOR POULTRY.

L. N. LAKE, Tauranga :—

Can you tell me whether crockery, glass, &c., put through a mill is good for ducks as well as hens? The hens appreciate it, but I have been doubtful about giving it to my ducks.

The Chief Poultry Instructor :—

It is on record that fowls have died from lead-poisoning as a result of eating certain kinds of crockeryware. In regard to broken glass, this is frequently passed in the droppings, and readily eaten again by the birds. It thus serves as ready means of spreading such a disease as tuberculosis, should any member of the flock be so affected, as the lesions are found almost invariably in the organs of the digestive system. Another drawback to broken glass is that the fine splinters are apt to become embedded in the birds' feet, causing corns, &c. Sharp stony grit as a means of assisting digestion, and freshly crushed sea-shell as an egg-shell-forming material, are recommended as best for both ducks and fowls.

MORTALITY AMONG LAMBS.

G. B. ELLIOTT, Tahuna :—

Would you please advise me of cause of and treatment for prevention in a trouble that I am having with some of my lambs. Lambs of perhaps two days to a week old sicken and die. The ewes in all cases have plenty of apparently good milk, and strong single lambs only seem to be affected. In a number of cases I have given the ewes other lambs with satisfactory results. I am running the ewes off as they lamb on to pasture that has been shut up for about a month before lambing. The grass is not particularly good, but in general the sheep are doing well. It is good country, fairly highly manured. The affected lambs do not seem to die in any pain, but just pine away, although they are dead in twenty-four hours after first showing signs of sickness.

The Live-stock Division :—

It appears probable that the cause of death is the ewes' milk becoming affected adversely by the change of pasture. The sudden change on to good pasture that has been manured and shut up for a month may upset the digestive organs of the ewe, and in consequence the lamb may become affected through the milk. The reason why the strong single lambs are affected is probably because these particular lambs are obtaining a larger quantity of milk and are thereby affected more than others. The trouble might be prevented by putting the ewes into pasture that is shorter and therefore more suitable for freshly-lambed ewes. It is well known that mortality may be expected among lambs whose mothers are put on to good feed with the object of pushing the lambs forward rapidly.

Noxious Weeds Orders.—The following special orders by local bodies, declaring specified plants to be noxious weeds within the respective areas of jurisdiction have been gazetted: Waimea County Council—broom, fennel, foxglove, gorse; Taihape Borough Council—hemlock; Milton Borough Council—broom, dock, elderberry, gorse, wild turnip. The Marlborough County Council has passed an order rescinding all by-laws and previous special orders declaring certain plants to be noxious weeds within that County.

AGRICULTURAL SHOWS, SEASON 1928-29.

THE following show-dates have been notified by agricultural and pastoral associations :—

Hawke's Bay A. and P. Society : Tomoana, 17th and 18th October, 1928.
Poverty Bay A. and P. Association : Gisborne, 23rd and 24th October.
Wairarapa P. and A. Society : Carterton, 24th and 25th October.
Timaru A. and P. Association : Timaru, 24th and 25th October.
Marlborough A. and P. Association : Blenheim, 24th and 25th October.
Manawatu A. and P. Association and Royal Agricultural Society of New Zealand :
Royal Show, Palmerston North, 30th, 31st October, and 1st November.
Ashburton A. and P. Association : Ashburton, 1st November.
Northern A. and P. Association : Rangiora, 2nd November.
Wanganui A. and P. Association : Wanganui, 7th and 8th November.
Canterbury A. and P. Association : Christchurch, 8th and 9th November.
Egmont A. and P. Association : Hawera, 14th and 15th November.
Stratford A. and P. Association : Stratford, 21st and 22nd November.
Nelson A. and P. Association : Richmond, 23rd and 24th November.
Auckland Metropolitan A. and P. Association : Auckland, 23rd and 24th November.
Helensville A. and P. Association : Helensville, 29th January, 1929.
Feilding A. and P. Association : Feilding, 5th and 6th February.
Dannevirke A. and P. Association : Dannevirke, 12th and 13th February.
Masterton A. and P. Association : Solway, 19th and 20th February.
Te Awamutu A. P. and H. Association : Te Awamutu, 20th March.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 26th July to 6th September, 1928, include the following of agricultural interest :—

No. 58060 : Honey uncapping-knife ; J. H. Roberts, Christchurch. No. 60619 : Fertilizer ; B. Bodero, Paris, France. No. 58585 : Seed-sower ; E. C. Houchen, Hamilton. No. 59331 : Wool bale ; R. D. Coghill, Dunedin. No. 59348 : Milk sterilizer ; F. de Boer ; Gorredijk, Holland. No. 60317 : Coating cheese with wax ; E. D. Berry, Palmerston North. No. 60634 : Device for separating wool-fat from wool-scouring wash ; J. and C. E. Thomson, Dunedin. No. 60721 : Trap ; J. P. Flight, Rangemore, N.S.W. No. 60727 : Device for flexibly securing animal traps ; Henry Lane (Aust.), Ltd., Sydney. No. 59177 : Hemp fibre, &c., treatment ; R. D. Coghill, Dunedin. No. 60693 : Horse collar ; D. MacQueen, Denmark, Western Australia. No. 60834 : Milking-machine ; E. G. N. and E. S. Salenius, Stockholm, Sweden. No. 60840 : Fencing dropper ; A. Arthur ; Northwood, Sydney, N.S.W. No. 60865 : Animal-trap ; H. C. Lane, Wednesfield, England.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office ; or fees may be remitted by Post Office order or postal note.

Farm Dairy Instruction.—Referring to this subject in his annual report for 1928, the Director of the Dairy Division states : "Although this system of instruction to the suppliers to dairy companies has now been in operation for a number of years, it has not during the past year shown the advance that its importance warrants. There are now thirty-one Farm Dairy Instructors employed by dairy companies, as against thirty-three for the preceding year. One new appointment was made in the South Island, and three officers were dispensed with in the North. The combination of cream-grading and farm dairy instruction on a national basis would be of inestimable value in the improvement of milk and cream supplies, and it is urged that dairy companies give this matter their serious consideration."

The New Zealand

Journal of Agriculture.

VOL. XXXVII. WELLINGTON, 20TH OCTOBER, 1928. No. 4.

DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF 1927–28 SEASON.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE season of 1927–28 brought forth a revived interest in the testing of dairy herds for yield, with the result that almost 54,000 more cows were tested than in the preceding season. Moreover, the level reached this last season represents 27,280 cows more than for 1924–25, when the hitherto greatest number in the history of the movement in New Zealand since the inception of cow-testing, in 1909, was recorded. In exact figures there were 170,150 cows tested in 1926–27, and 224,130 in 1927–28, an increase of 53,980 cows. The 224,130 tested animals represent 16½ per cent. of the total of the Dominion's dairy cows in milk and dry.

Readers conversant with the subject will recall that dairy-herd testing in New Zealand is carried out under several variants of our original method, and that three systems are now generally recognized —namely, "Association," "Group," and "Dairy Company." Under the Association system the members themselves do the weighing and sampling of their cows for two days (in a few cases one day) in every thirty days, while in the case of the Group system weighing and sampling of the milk for each cow on test is done by a testing officer for one day every month. In both cases samples are tested by testing officers, returns figured, and sheets containing results returned to the dairy-farmers. Testing under the Dairy Company system resembles the Association method, except that the figuring of returns is left to the herd-owners themselves.

Details of classification under these three systems for the past five seasons are given in Table 1, while the accompanying graph gives a clearer conception of the relation between the number of cows tested under each system and as a whole. The graph goes back six seasons. This enables the inclusion of 1922–23, the first year of group testing in New Zealand, and thus an interesting survey of the progress of group testing and of its tendency to replace the original Association system is afforded. A fact immediately apparent from a survey of this table is the marked increase in the Group system—an advance

Table 1.—Number of Cows tested Twice or more, classified according to Season and System of Testing.

System.	1923–24.			1924–25.			1925–26.			1926–27.			1927–28.		
	Organi-zations.	Cows.	Average Cows per Organi-zation.	Organi-zations.	Cows.	Average Cows per Organi-zation.	Organi-zations.	Cows.	Average Cows per Organi-zation.	Organi-zations.	Cows.	Average Cows per Organi-zation.	Organi-zations.	Cows.	Average Cows per Organi-zation.
Association	114	96,198	844	117	87,695	750	124	59,345	479	116	56,823	489	115	56,699	493
Group ..	34	43,144	1,269	91	100,055	1,100	86	105,227	1,224	96	109,827	1,144	127	164,610	1,296
Dairy Company	42	11,872	283	51	9,100	178	38	5,204	137	28	3,500	125	18	2,821	157
All ..	190	151,214	796	259	196,850	760	248	169,776	685	240	170,150	709	260	224,130	862

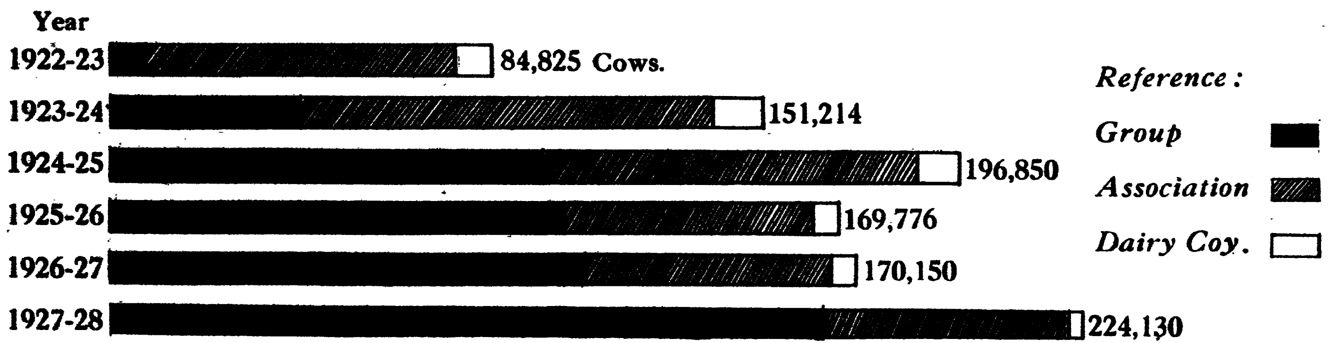


FIG. 1. GRAPH SHOWING EXTENT OF HERD-TESTING IN NEW ZEALAND FOR LAST SIX SEASONS—AS A WHOLE AND ACCORDING TO SYSTEM.

of 54,783 cows. The Association system just fails to reach last season's number, and Dairy Company testing has decreased. It will also be observed that there were 127 groups in operation last year, as compared with 96 in 1926–27, an increase of 31.

In Table 2 the number of cows tested has been taken out in land districts, and, perused in conjunction with similar classification for the four previous seasons, the table furnishes an interesting review. As will be seen, the increase in total cows tested last season is due principally to the marked advance in testing in the North Island, although the South Island shows an increase of approximately 2,600 cows. The increase in the North Auckland Land District is remarkable, although each North Island district shows a decided upward trend from last year. It is gratifying to record a good increase in the figures for Southland.

Table 2.—Number of Cows tested Twice or more, classified according to Season and Land District, &c.

Land District, &c.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.
North Auckland	23,521	31,049	24,951	24,616	41,067
Auckland	63,945	93,912	77,651	82,338	101,796
Gisborne	3,122	4,022	3,[illegible]01	2,626	5,756
Hawke's Bay ..	4,391	5,468	4,9[illegible]	2,987	4,638
Taranaki	18,567	16,840	16,485	14,696	23,581
Wellington	30,584	37,415	29,653	29,517	32,267
North Island ..	144,130	188,706	157,533	156,780	209,105
Nelson	1,192	574	880	620	656
Marlborough ..	175	147	441	258	434
Westland	771	..	..	74	..
Canterbury	2,345	2,171	1,799	4,292	3,280
Otago	2,416	1,859	903	950	769
Southland	185	3,393	8,220	7,176	9,886
South Island ..	7,084	8,144	12,243	13,370	15,025
Dominion	151,214	196,850	169,776	170,150	224,130

Table 3 presents the numbers of cows, herds, and associations, together with the average size of herds and associations represented in all effective annual summaries (on the 100-days-or-more basis) received for the past three seasons. In view of the increase recorded in total cows tested, this table runs out much as might be expected. A noticeable feature, however, is the large increase in the average number of cows per association. The term "association" as used in this table denotes a herd-testing organization, whether Group, Association, or Dairy Company. As mentioned in previous reviews, there is, unfortunately, a confusion in herd-testing nomenclature, inasmuch as organizations operating under either the Group or the Association system are termed "herd-testing associations," or simply "associations." In some districts there is a tendency to call the original association

method the "individual" system, but it is doubtful if this is not even more confusing to the average person.

Table 3.—Number of Cows, Herds, and Organizations represented in Effective Seasons' Summaries received. (Basis: All Cows in Milk 100 Days or over.)*

—	1925-26.	1926-27.	1927-28.
Number of organizations	201	211	242
Number of herds	4,458	4,678	5,927
Number of cows	146,398	155,028	206,323
Average number of herds per organization	22	22	24
Average number of cows per herd ..	33	33	35
Average number of cows per organization..	728	734	853

* Including both Group and Organization systems, and on basis of sections or units.

In Table 4 the groups and associations are classified according to herds and cows. It will be noted that the number of cows per group and per association shows an increase. The outstanding feature of this table is that the group herds are more than twice as large as those on Association test. This is due partly to the fact that a group can be operated most successfully and economically among larger herds, and partly because most group organizations insist that all sound cows in the herd shall be tested. Frequently only those cows hitherto untested are entered in Association test, and an association often operates among small farmers in scattered districts where a group would not be practicable.

Table 4.—Average Size of Associations and Groups for which Effective Seasons' Summaries on the Basis of all Cows in Milk 100 Days or over were received.

System.	Season.	Average Number of Herds per Association or Group.	Average Number of Cows per Association or Group.	Average Number of Cows per Herd.
Association ..	1924-25	25	574	23
	1925-26	19	407	22
	1926-27	18	408	22
	1927-28	21	414	20
Group ..	1924-25	26	1,185	45
	1925-26	27	1,205	44
	1926-27	26	1,127	43
	1927-28	28	1,250	45

AVERAGE YIELD OF TESTED COWS.

It is pleasing to be able to report concerning the collection of data pertaining to herd-testing that effective summaries received for the 1927-28 season represent over 92 per cent. of the total number of cows tested twice or more for all groups and associations. Appreciation is again recorded of the prompt and accurate manner in which officers

in charge of the various herd-testing organizations have responded to our requests for summaries of results. Production summaries for purposes of this review are based on all cows in milk 100 days and over, which is the accepted standard for the compilation of ordinary herd-testing returns. The number of cows represented in effective summaries to hand for last season reaches the total of 206,323, an increase of 51,295 over the 1926–27 total.

As regards butterfat-production, last season's average-yield figure shows a decrease of 15·80 lb. from that of 1926–27, the average production for 1927–28 being 224·68 lb. butterfat and for the previous season 240·48 lb. More than one factor played a part in bringing about this falling-off. In the first place, 1926–27 was climatically an exceptionally favourable season, whereas last season was marred by drought; so that, considering the two seasons from a climatic point of view as applying to dairying they represented almost two extremes. Then, again, 54,000 more cows were tested last year, involving the breaking of new ground by the extension of herd-testing to more outlying districts. This would probably mean the inclusion of many less-improved farms, and many herds in the first stages of building-up, and consequently of a number of lower-yielding individuals, which would tend to lower the general average. Another phase of the question is revealed by the fact that whereas at 31st January, 1927, there were in New Zealand 1,303,225 dairy cows in milk and dry, by 31st January, 1928, this number (according to the Government Statistician's interim figures) had risen to 1,352,513, an increase of 49,288. Unfortunately, figures relating to cows actually in milk at the last enumeration are not yet available, but those just quoted are sufficient to show that our dairy-farmers were actually milking more cows last season. This would include to a certain extent first calvers and cows hitherto untried, and these would probably also adversely affect the grand average. All things considered, the average yield of all cows on herd test last season—namely, 224·68 lb. butterfat—must be accepted as very creditable. A grand summary of production results for the past seasons is supplied by Table 5.

Table 5.—Grand Summary of all Effective Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

—	1926–27.		1927–28.	
	Days in Milk.	Butterfat-production.	Days in Milk.	Butterfat-production.
		lb.		lb.
Average for all cows (155,028 in 1926–27 and 206,323 in 1927–28)	236	240·48	230	224·68
Highest Association or Group average ..	240	357·46	258	377·70
Lowest Association or Group average ..	131	94·88	185	116·08
Highest herd average	317	511·91	272	484·88
Lowest herd average	100	65·13	112	68·03
Highest cow	276	795·09	263	858·20
Lowest cow	103	17·44	130	7·74
Average daily production of butterfat for all cows	..	1·02	..	0·98

In Table 6 average production is classified according to system of operation, the two principal systems, Group and Association, being the classifications adopted. As would probably be anticipated from the foregoing comment concerning the average yield of all cows tested, averages under both systems show a decline. The Association average dropped by 20·61 lb. of butterfat, and the Group average fell some 15·42 lb.

Table 6.—Average Production of all Effective Results for Past Three Seasons classified according to System. (Basis : All Cows in Milk 100 Days or over.)

Season.	System.	Number of Associations or Groups.	Number of Herds.	Number of Cows.	Average Days in Milk.	Average Butterfat.
						lb.
1925–26 ..	Association	120	2,239	48,823	217	215·40
	Group ..	81	2,219	97,575	236	223·06
1926–27 ..	Association	115	2,140	46,878	220	232·64
	Group ..	96	2,538	108,150	241	243·88
1927–28 ..	Association	115	2,389	47,589	204	212·07
	Group ..	127	3,538	158,734	237	228·46

Figures on hand in the Dairy Division's head office, where is carried out the figuring of returns for associations conducted by officers of the Division, enable us to take out each year a summary founded on all cows in milk 210 days or more. This classification cannot be run out for all cows tested in the Dominion, as the information is not available for cows tested in privately controlled organizations. A 210-day summary provides results more in conformity with the length of a dairying season, and is more exact evidence of what our average normal cow is capable of producing. On the other hand, the 100-day summary includes performances of some cows of such poor quality that they do not milk 210 days. It has the disadvantage, however, of including certain records which should perhaps be omitted—the records, for example, of cows that have died, fallen sick, or been sold or culled, and thus discontinued prior to the date on which under normal circumstances their test would have been completed.

Table 7 gives production results under the headings of cows in milk 100 days and more and cows in milk 210 days and more for associations tested by officers of the Dairy Division. It will be observed that the average 100-days-or-more yield practically equals last year's figure, while the average yield in the 210-days-or-more class, which stands at 282·54 lb. butterfat, shows an increase of 9·15 lb. These results are contrary to the past season's results for herd-testing as a whole, the probable explanation being that the majority of associations conducted by Dairy Division officers have been in operation for several seasons, and consequently the influence of herd-building is in evidence.

Table 7.—Average Production for Associations conducted by Officers of the Dairy Division, comparing Difference in Production between Results of Summaries compiled on the Basis of all Cows in Milk 100 Days or more and 210 Days or more.

Year.	100 Days or more.		210 Days or more.	
	Average Days.	Average Butterfat.	Average Days.	Average Butterfat.
		lb.		lb.
1923-24	227	221·39	258	267·10
1924-25	223	231·51	258	266·29
1925-26	218	221·19	257	259·20
1926-27	236	247·35	262	273·36
1927-28	229	246·91	264	282·54

Table 8 provides a more detailed production classification, and enables a comparison by land districts. As was to be expected, many of the land districts show a decrease in average production from the preceding season. It will also be observed that in almost every instance the largest decrease occurred in those land districts which showed the greatest advance in total numbers of cows tested. It is pleasing to note that the South Island records an increase in average yield as well as in total number of cows tested.

Table 9 has been compiled in order to illustrate the difference in distribution of records for results from the two systems—Group and Association. In the upper half of each of the two season's tabulations the numbers of records are given, while in the lower half these have been converted to percentages. This table is useful in showing where the cows which lower the average occur. It will also be apparent that many unprofitable producers of butterfat are being milked, and how much more favourable the yield of our average cow would be could we eliminate all those animals which fail to produce a quantity of butterfat equal to the present average. This point is more or less emphasized by Table 10, and numbers of the records from which the table was compiled make it clear that the higher average yield of cows in the 210-days-or-more class is not accounted for by the fact that it contains more higher-yielding animals, but because there are fewer cows in the lower-production classes.

Fig. 2, which should be studied in conjunction with Table 10, reveals in a clear form a very interesting position. This graph is based on the data supplied by Table 10, with the exception that the curves have been "smoothed" slightly. The graph supplies the percentage frequency of records appearing in the various classes as marked along its base. It will be observed that two seasons are represented—1925-26 and 1927-28—this graph not having been compiled last year or prior to the 1925-26 season. By "percentage frequency of occurrence" is meant the percentage of the total number of records represented by the number of records which fall within the limits of production within each butterfat-production class specified along the base line of the graph. It will be quite obvious that the trend of the records is towards the higher-production classes, and that the number of low-producing cows is gradually decreasing. This, after all, should be the aim of every dairy-farmer—not so much the elimination of the poor cow as the replacement of the poor cow with a higher-yielding animal.

Table 8.—Average Production, according to Land Districts, &c., of all Cows under Herd-test for which Effective Seasons' Summaries were obtained. (Basis: All Cows in Milk 100 Days or over.)

Land District, &c.	1924–25.			1925–26.			1926–27.			1927–28.		
	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.
			lb.			lb.			lb.			lb.
North Auckland	25,685	216	205·14	20,925	224	210·94	21,471	224	232·46	36,395	211	191·66
Auckland	77,003	235	224·98	73,101	236	226·08	78,625	240	244·82	95,799	235	225·04
Gisborne	3,455	204	208·34	3,368	212	191·03	2,405	217	218·08	5,244	231	234·39
Hawke's Bay	4,575	243	233·25	4,294	224	189·32	2,285	230	208·95	4,107	230	233·72
Taranaki	11,683	233	251·58	12,846	235	242·42	12,857	241	239·67	22,180	238	247·01
Wellington	24,199	228	230·99	22,043	223	212·64	25,400	258	256·53	29,300	233	244·89
North Island ..	146,600	230	224·48	136,577	231	221·11	143,043	240	252·29	193,025	230	224·72
Nelson	104	258	283·16	609	192	207·16	261	233	239·27	341	154	162·44
Marlborough	..	..	..	..	..	..	..	..	..	..	..	..
Westland	..	..	..	..	..	..	..	..	..	..	..	..
Canterbury	909	196	213·15	391	195	217·21	3,917	207	219·03	2,847	226	222·57
Otago	1,249	204	203·04	804	218	223·60	820	199	247·02	720	239	273·42
Southland	3,013	191	187·28	8,017	217	211·14	6,987	217	215·36	9,390	220	222·94
South Island ..	5,275	197	197·36	9,821	214	212·15	11,985	213	219·06	13,298	221	224·04
Dominion	151,875	229	223·54	146,398	230	220·51	155,028	238	240·48	206,323	230	224·68

Table 9.—Distribution of Records for all Tested Cows in the Dominion represented in Effective Annual Summaries received, Seasons 1926–27 and 1927–28. (Basis: In Milk 100 Days or over.)

System.	Class Limits (in Pounds of Butterfat).																		Total Number of Cows classified.
	Under 50.	50–100.	100–150.	150–200.	200–250.	250–300.	300–350.	350–400.	400–450.	450–500.	500–550.	550–600.	600–650.	650–700.	700–750.	750–800.	800–850.	850–900.	
1926–27.	*Numbers.*																		
Association	42	1,653	6,090	9,441	10,855	8,903	5,545	2,663	954	289	75	23	7	2	..	..	..	..	46,542
Group ..	89	2,251	8,946	19,098	26,396	23,644	15,035	7,010	2,603	799	203	47	9	4	..	2	..	..	106,136
Both ..	131	3,904	15,036	28,539	37,251	32,547	20,580	9,673	3,557	1,088	278	70	16	6	..	2	..	..	152,678
	Percentages.																		
Association	0·09	3·55	13·08	20·28	23·32	19·12	11·91	5·72	2·04	0·62	0·16	0·04	0·01	*	..	..	..	..	46,542
Group ..	0·08	2·12	8·42	17·99	24·86	22·27	14·16	6·60	2·45	0·75	0·19	0·04	*	*	..	*	..	..	106,136
Both ..	0·08	2·55	9·84	18·69	24·39	21·31	13·47	6·33	2·32	0·71	0·18	0·04	0·01	*	..	*	..	..	152,678
1927–28.	*Numbers.*																		
Association	41	2,386	8,947	11,449	10,398	7,433	4,314	1,743	648	168	40	16	3	2	..	..	..	1	47,589
Group ..	552	5,620	19,194	34,598	39,525	31,326	17,956	7,062	2,163	563	127	35	7	2	3	1	..	..	158,734
Both ..	593	8,006	28,141	46,047	49,923	38,759	22,270	8,805	2,811	731	167	51	10	4	3	1	..	1	206,323
	Percentages.																		
Association	0·09	5·01	18·80	24·06	21·85	15·62	9·07	3·66	1·36	0·35	0·08	0·03	0·01	*	..	..	..	*	47,589
Group ..	0·35	3·54	12·09	21·80	24·90	19·73	11·31	4·45	1·36	0·35	0·08	0·02	*	*	*	*	..	..	158,734
Both ..	0·29	3·88	13·64	22·32	24·20	18·78	10·79	4·27	1·36	0·35	0·08	0·02	*	*	*	*	..	*	206,323

* Data occurring, but relatively insignificant.

Table 10.—Percentage Distribution of Records and Herd Averages in Organizations controlled by Dairy Division.

Basis.	Class Limits (in Pounds of Butterfat).														Total Number classified.
	Under 50	50–100	100–150	150–200	200–250	250–300	300–350	350–400	400–450	450–500	500–550	550–600	600–650	650–700	
						Records.									*Cows*
100 days and over	00·05	1·91	10·65	17·89	21·80	21·75	15·11	6·94	2·94	0·70	0·20	0·04	0·01	..	7,88.
210 days and over	..	0·04	1·34	9·67	22·67	28·29	21·89	10·22	4·45	1·04	0·31	0·06	0·02	..	5,21
						Herd Averages.									*Herds*
100 days and over	..	1·43	9·35	18·71	23·26	27·10	14·63	4·56	0·96	..	..	..	..	..	41
210 days and over	..	..	0·32	4·19	21·61	38·39	26·13	7·74	1·61	..	..	..	..	..	31

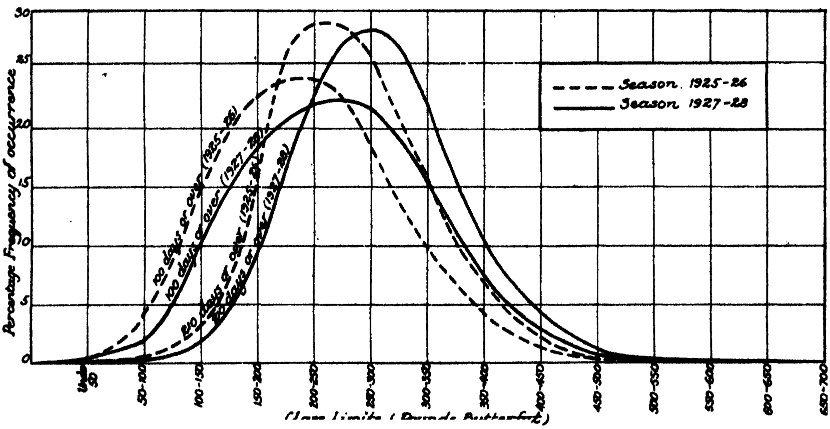


FIG. 2. COMPARISON OF THE PERCENTAGE FREQUENCY DISTRIBUTION OF RECORDS.

CONCLUSION.

Despite the fact that, for reasons given at the commencement of these notes, the production of last season's average cow was not so high as in 1926–27, New Zealand produced more butterfat, indicating that our dairy-farmers milked more cows. It is also apparent that we are gradually replacing our poorest cows with better producers. Market values and general trade conditions suggest better returns from dairying than those of late years, and a further material development of the industry in the Dominion appears to be assured.

Herd-testing now appears to be safely on the ascendant, and there is every indication that a larger number of cows will be milked and more cows tested during the current season than ever before. The subsidy to herd-testing granted last year by the Government was welcomed by dairy-farmers, and no doubt had a part in increasing herd-testing entries. The subsidy has been renewed, and £10,500 is reserved for distribution among testing herd-owners through their organizations this season.

THE GRASSLANDS OF NEW ZEALAND.

GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

E. BRUCE LEVY, Agrostologist, Plant Research Station, Palmerston North.

(8) Ratstail (Sporobolus indicus).

DURING the past few years many species of grasses and clovers have been reviewed and carefully weighed in the light of the newer conception—namely, that conditions of soil-fertility, soil-moisture, light and shade, climate, and management govern which species are the most profitable for the farmer to use. There is the rye-grass habitat or growing-place, the cocksfoot habitat, the brown-top habitat, and the danthonia habitat, already dealt with in this series. No grass perhaps has been more difficult to allocate to its proper place in the ecologic classification of species and to get accepted by pastoralists and agricultural advisers than ratstail.

Moderately warm climatic conditions, low-fertility soils usually of a loose friable nature such as sand, pumice, and limestone, characterize the ratstail habitat. This grass will grow and persist on soils poorer in quality and more difficult even than those where Danthonia pilosa thrives. It falls more naturally, so far as its growing-place is concerned, along with low-production grasses such as bay-grass (*Eragrostis Brownii*), Grimmer grass (*Triodia decumbens*), and Danthonia semiannularis, although there is no doubt that on sufficiently warm areas ratstail can compete successfully against Danthonia pilosa, particularly when allowed to get away rank. (Fig. 137.) On certain hydraulic-limestone country in North Auckland where the physical conditions of the soil are difficult to maintain right for cocksfoot, &c., ratstail has spread and has formed a tall dense growth that entirely prohibits the establishment or spread of low-growing grasses and clovers. Under ungrazed conditions, therefore, owing largely to its tallness of growth, ratstail may assume complete dominance and completely master danthonia and other low-productive, low-growing species. (Fig. 138.)

In growth-form ratstail is a tussock; the crown is below ground, and spread is by means of short underground tillers and from seed shed. The root-system is extensive, and the larger roots penetrate 2 ft. or more into the subsoil. The grass is held in low repute by many farmers, largely on account of the toughness of its rather broad, erect leaves. Ratstail is a native of Chili and " according to the late Bishop Williams made its first appearance at the Bay of Islands in 1840, shortly after the arrival of a ship called the *Surabayo*, which, while on a voyage from Valparaiso to Sydney laden with horses and forage, put into the Bay of Islands in a disabled state and was there condemned and her cargo sold."*

Ratstail has not the wide distribution over New Zealand that Danthonia pilosa has. It will not tolerate extreme cold, and its climatic range coincides somewhat with that of paspalum, although its adaptability to poorer soil-conditions would make it appear much more tolerant of cold than the latter grass. In North Auckland large areas of ratstail

* " Tutira, the Story of a New Zealand Sheep Station," p. 179; by H. Guthrie-Smith.

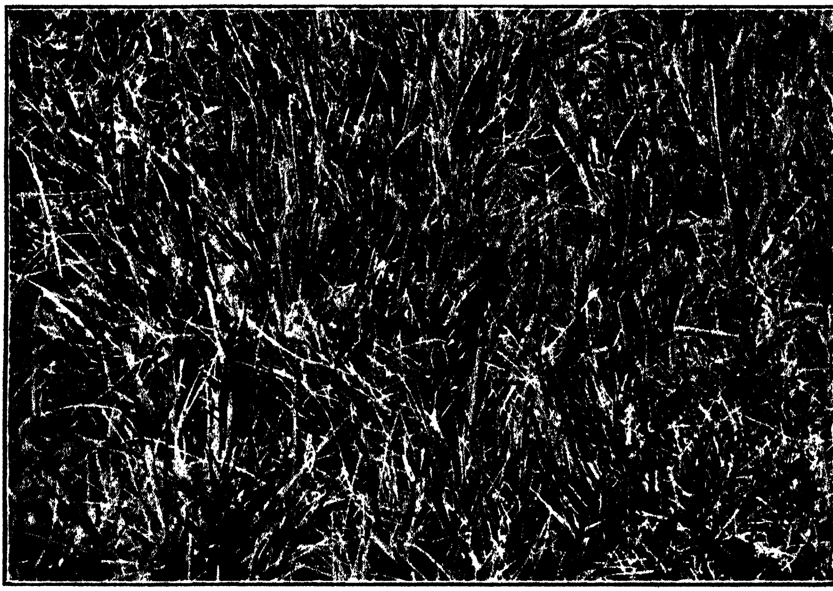


FIG. 137. PURE ASSOCIATION OF RATSTAIL ON COUNTRY TOO POOR FOR THRIVING OF BROWN-TOP OR ANY BETTER GRASSES.

Here ratstail by its taller growth suppresses any danthonia in the sward, and precludes its further establishment.

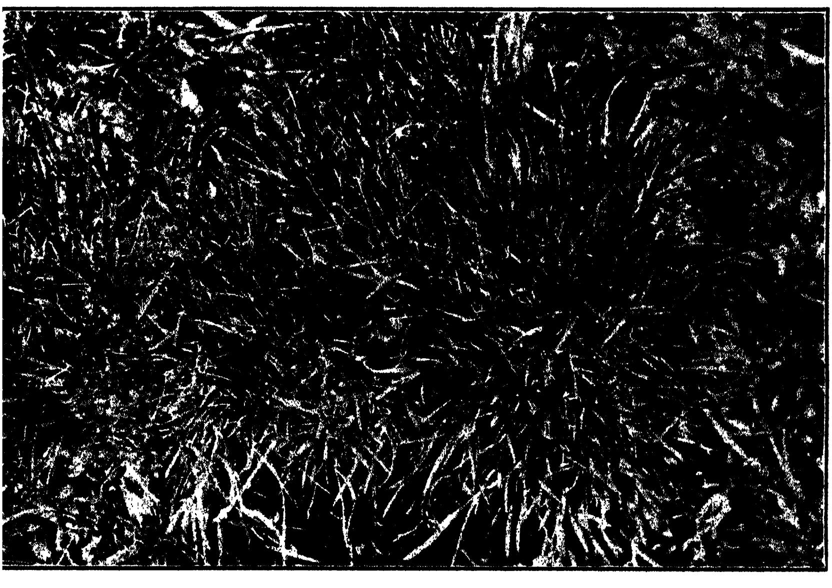


FIG. 138. DANTHONIA SUPPRESSION BY RATSTAIL.

On the sunlit edge of the ledge shown danthonia is persisting, but the ratstail is ousting it elsewhere. Along the coast, particularly of the North Island, ratstail unless kept closely grazed will probably replace danthonia.

[Photos by E. Bruce Levy.

have been cleared by late autumn or winter burning, thus exposing the crown and any fresh growth to frost. (Fig. 139.) The grass, however, thrives quite well along the entire coastal country of the North Island, and inland to as far south as the Wanganui River, and possibly farther. In the South Island it is confined largely to the coast of the northern end of the Island on the east, but extends farther south on the west. These climatic bounds, however, may not represent the extreme ultimate limits for ratstail in New Zealand. Within the colder areas we know that spread from seed shed is extremely slow, and as comparatively little seed of this species has ever been intentionally sown within

FIG. 139. STRONG RATSTAIL BURNT IN LATE AUTUMN.

The large bare patch in the photo is where the fire spread, and the ratstail is largely killed out. Much effective work has been done in North Auckland by burning ratstail, surface-sowing with seed, and subsequently top-dressing with manure.

[Photo by E. Bruce Levy.

these areas there is little chance afforded of knowing without definite experimental work just what the ultimate climatic range may be.

There is no doubt that for the general dry hard-conditioned soil-type throughout New Zealand the grass that has the widest application throughout the entire range of such lands is Danthonia pilosa ; but for special warm country, particularly coastal, throughout both Islands, the native danthonia has a big rival in the alien ratstail.

It is almost inconceivable that the New Zealand danthonia soil-type has not its counterpart in other parts of the world. Such will be grassed by species akin to danthonia in demand of soil-fertility requirement,

soil-moisture, light and shade, &c., and when these are introduced into the danthonia habitat here the struggle with our like-demanding species is apt to be keen, and generally speaking the taller grower will survive. It would appear, therefore, that throughout much coastal country, in the North Island particularly, ratstail will gradually assume dominance over danthonia, especially so under light grazing. Under close and continuous grazing which permits plenty of light to the danthonia crown, and which somewhat prejudicially affects the tussocky ratstail, the odds are essentially more equal, and ratstail and danthonia may blend one with the other, making a close and continuous turf. (Fig. 140.)

VALUE OF RATSTAIL.

Ratstail has some very strong supporters, and among these are men of high standing in pastoral New Zealand. Mr. H. Guthrie-Smith and Mr. Bernard Chambers (Hawke's Bay) may be mentioned as the foremost advocates of this grass. Mr. Chambers writes :—

I consider ratstail has no superior on certain soils ; the Kiwi Valley, on the Wairoa Road on Waihua Run, used to be barren useless land covered with stunted manuka a foot or so high. The spreading of ratstail and danthonia has made it one of the finest pastures I know. On the light pumice spurs also of Kiwi Station, where other grasses died out, ratstail formed a beautiful close sward. If kept in order by cattle, it is always grazed close by sheep, and the blades are sweet like those of prairie-grass ; weedy hoggets following thrive wonderfully on the grass and do not scour. I know land north of Gisborne that has been made by ratstail in the grass-seed mixture. On the Havelock North hills in spring-time, directly they begin to burn up, both sheep and cattle neglect danthonia and graze each tuft of ratstail close. . . . At Mokau, Mohakatino, and our Mangtoi Station leasehold, twenty miles up the Mokau River, ratstail stands ahead of all other species on spurs which grew only tawhero (kamahi) and rewarewa, a sure sign of poor light soil. On them cocksfoot, rye-grass, and every other grass died out and gave way to catsear and suchlike rubbish. On those spurs wherever ratstail has got in it has made a beautiful closely-cropped sward.

In a recent communication from Mr. Guthrie-Smith regarding the merits of ratstail for the so-called Hawke's Bay pumice-lands he says :—

Over areas I am describing there is a normal surface of four or five inches of dark dusty humus, then a sheet of four or five inches of grit, then deeper down either a poorish clay or a deposit of packed water-laid reddish sand ; this last contains evidently at least a whiff of clay, as it becomes *hinu* and greasy when wet. For such soils a deep-rooting grass is pre-eminently required. It is supplied by ratstail, which has a root-system exceeding, I should imagine, that of any other pasture-grass in New Zealand. Ratstail in this type of land is able to assimilate any virtues which may exist in the top dusty dark humus, penetrating which it then pierces the pumice land, and is then still able to search for nutriment a good foot into the clays and greasy sand-grits beneath. No wonder we think highly of it ; no wonder it can grow on wretched utterly infertile (surface infertile) northern and western-facing knee and elbow knobs. In such miserable areas—cited purposely because extreme cases of poverty—ratstail has a genuine feeding-value. On normal pumice areas this feeding-value, of course, greatly increases. On lands not properly worked, where mixed danthonia and ratstail grow, everywhere it is my experience that ratstail is bitten close while danthonia stands untouched. Quite good as the latter may be as a poor-country grass, ratstail beats it out of the field because of its enormously developed root-system. Danthonia cannot feed as deep, and therefore cannot reach sources of nourishment open to a rival that can penetrate twenty-four inches into the subsoil. Although not a cold-country plant, this root penetration enables it to maintain a considerable growth even in the winter ; throughout the cold months fresh leaves can always be found rising stiff and stark from the hard uninviting mat. On the tens of thousands of acres of light hill country in northern Hawke's Bay facing north and west—lands hopeless for any other crops than trees—ratstail is the only grass that will provide feed for sheep, and especially (relatively) winter feed ; if ever there

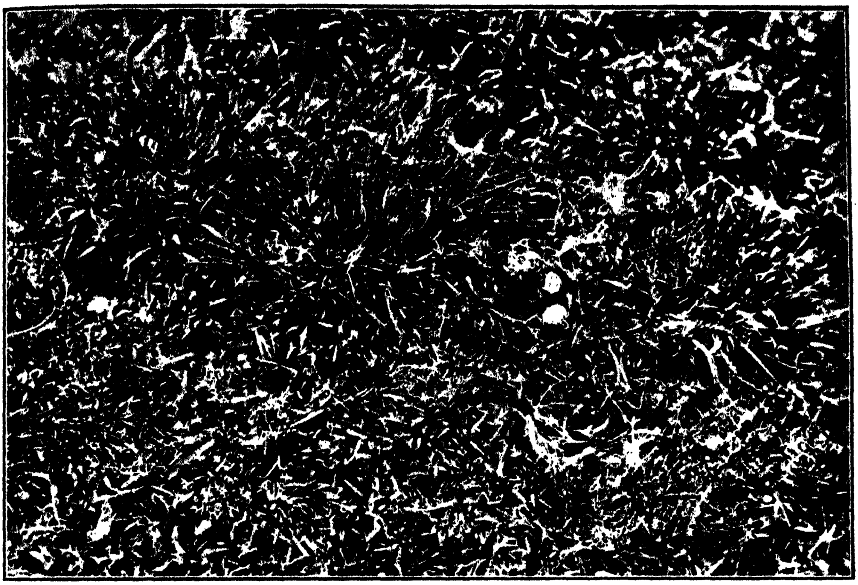


FIG. 140. RATSTAIL AND DANTHONIA PILOSA IN CLOSELY GRAZED SWARD.

Here the conditions are such that ratstail, being closely cropped, cannot overshade the danthonia, and itself is retarded in its development. Thus the two species thrive side by side, making an excellent close and continuous sward.

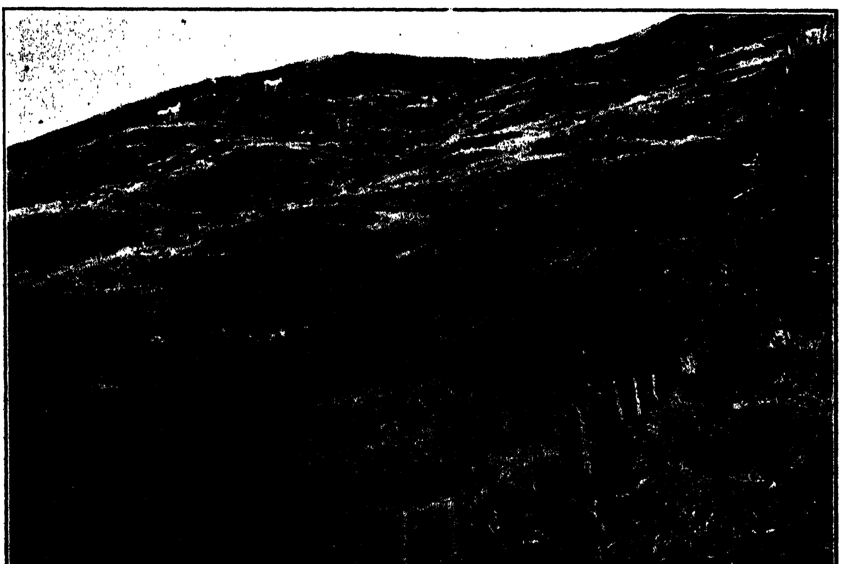


FIG. 141. RATSTAIL ON THE EAST COAST OF THE NORTH ISLAND.

On the left of the fence ratstail is rank and dominant. Such a paddock, while bad from a herbage utilization point of view, is a great standby in the case of summer drought or in a severe winter. [*Photos by E. Bruce Levy.*

was a poor man's grass it is ratstail. So much for pumice areas. On sound limestone lands where after forty years of feeding the better English grasses and clovers have disappeared ratstail is equally valuable, not only in itself but also from its habit of growth. It grows, even where thick, not quite densely enough entirely to exclude such another invaluable alien as suckling clover. When ratstail shall have spread over my limestone lands they will, I am confident, carry another quarter-sheep per acre. On bad lands, therefore, as also on the excellent fertile limestone of mid Hawke's Bay, ratstail stands forth as a valuable pasture-plant.

It is not for me or any one else in New Zealand to gainsay the opinions of these men, for such opinions are based on the practical experience of a long lifetime, and come from a stock of wonderful general and specific knowledge of practically all pasture plants with which ratstail may be compared.

Ratstail pastures do not gain credit from their appearance. When at all long the pasture looks rough, and at all times lacks that nice green and even appearance characteristic of the regular turf-forming grasses. Even when closely grazed the tussocks appear somewhat raised, and the short stiff leaves present a bristle-brush appearance. It is generally held—and is true—that ratstail is hard on the mouth of sheep, and this has often been put up as an argument against the value of the grass. It must be borne in mind, however, that hill country where we recommend ratstail is not aged-sheep country under any turf whatever. In the words of Mr. Guthrie-Smith himself, " What flockmaster nowadays desires to keep his sheep as records in longevity ? " Even if the teeth are somewhat worn and rather belie the animal's age, any practical man when sheep from ratstail country are exposed for sale understands the position, and the fact will scarcely affect his bid.

POINTS IN MANAGEMENT.

The men whose experiences have been cited are large holders and are well equipped with cattle. Perhaps no grass demands stricter attention by " cattleing " than does ratstail. The ill repute in which it is held by many farmers may be attributed largely to the fact that in such cases few or no cattle were available to render it suitable forage for sheep. Ratstail management is distinctly correlated with plenty of cattle, and without this all-important implement ratstail may prove a curse rather than a blessing. This, however, to quote Mr. Guthrie-Smith, " is not the fault of the grass, but of the landowner who does not understand his business ; it is a species that must be cattled, just as danthonia or cocksfoot or any other pasture must be cattled, to give best results."

There is no doubt that young ratstail growth is highly nutritious ; all classes of stock—horses, cattle, and sheep—thrive remarkably well on it. It has been said that horses grazing on ratstail thrive equally well as oaten-chaff-fed horses ; but it is equally true that grazing horses feed largely on extremely short herbage. This emphasizes the need of keeping ratstail short.

An aspect of ratstail that also is a recommendation is that the grass forms a reliable standby in a lean period. Whereas all pastoralists will agree that young growth is the most nutritious, and the exploitation of young growth is the crux of pasture-utilization for maximum value per given weight of herbage consumed, yet on virtually all the poorer hill-country runs the factor of rough growth to tide over crucial summer and

FIG. 142. STRONG, TALL GROWTH OF RATSTAIL ON HEAVY HYDRAULIC-LIMESTONE COUNTRY, NORTH AUCKLAND.

Here so tall and dense a growth of ratstail has been produced that all the lower-growing grasses and clovers are smothered out. On small holdings where wet stock are mainly employed the management of ratstail is extremely difficult, and under conditions such as shown every effort should be made to manure ratstail out.

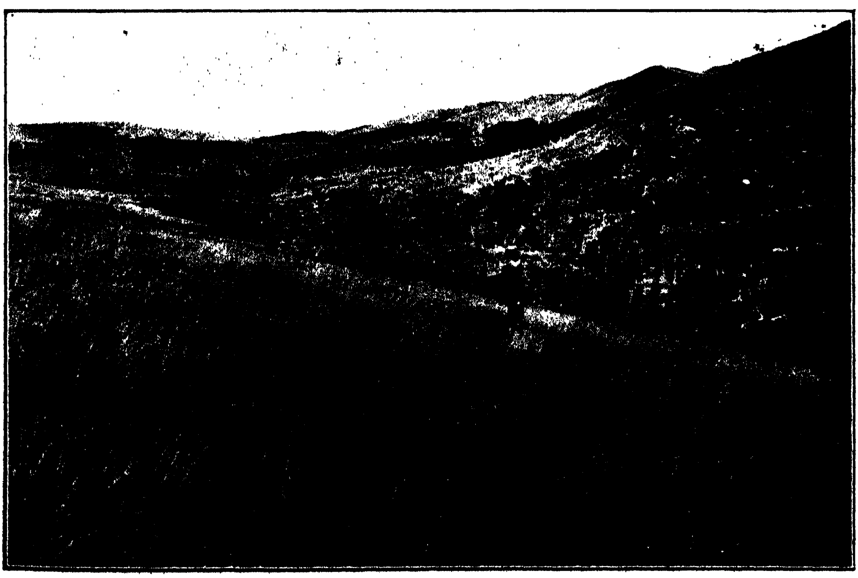


FIG. 143. RATSTAIL DOMINANT (IN FOREGROUND) ON HEAVY WET HYDRAULIC-LIMESTONE COUNTRY, NORTH AUCKLAND.

On this country there is sufficient rainfall to render available any artificial manures applied, and the effort here should be to so stimulate the better grasses and clovers as to keep ratstail out. [*Photos by E. Bruce Levy.*

winter periods of shortage is equally important as that of well-cropped, short young growth. Ratstail may essentially be relied on to provide this rough growth. Owing to the tough nature of its leaf it matures *in situ* as rough feed and does not lodge. Thus there is provided food of a sort that will at least sustain stock during a summer drought or through a severe winter. (Fig. 141.)

SIGNIFICANCE OF RATSTAIL DOMINANCE ON BETTER-QUALITY SOILS.

Ratstail on certain soils is capable of tall growth (Fig. 142), and in the absence of cattle it may assume control of country that would normally carry good danthonia, some Poa pratensis, crested dogstail, and a trace of cocksfoot and rye-grass—a turf which may be fairly easily managed with comparatively few cattle. This aspect of ratstail, particularly for the small landholder, must be carefully considered. I am not so sure with Mr. Guthrie-Smith that ratstail is a poor man's grass. Ease of management is essential for the small farmer, and the securing of this often more than compensates for any loss incurred through not using a higher producer that is difficult to manage—nay, almost impossible to manage without the expensive implement, cattle. In North Auckland this is strikingly well illustrated in the case of paspalum, and also in regard to ratstail on certain hydraulic limestone country about Paparoa. (Fig. 143.) This country is heavy, wet, and cold, and the physical conditions seem to render it unsuitable for thriving of the better grasses; yet it suits ratstail to perfection. On country such as this, burning and surface sowing of red and white clover, together with manurial top-dressing, often results in the entire elimination of ratstail. It is really a soil-type that should not be carrying ratstail, being wet enough to render available any phosphate manure that may be applied. Ratstail cannot compete successfully against a strong-growing turf of the first-class English grasses and clovers, and even moderately-well-growing brown-top and Lotus major prove more than a match for ratstail. (Fig. 144.) On country, therefore, that is wet enough to render artificial manures readily available, just as the manuring out of danthonia and brown-top is advocated, so here ratstail should not be tolerated, and its elimination from such country, as shown in Figs. 142 and 143, should be the aim of the farmer. Even where the ratstail is not quite eliminated the presence of clovers induced by the manuring renders the ratstail pasture of much greater value. (Fig. 145.)

On country that can be heavily tripod-harrowed in conjunction with manuring the process of eliminating ratstail is made easier. The tussock of ratstail is torn by the harrow, and, provided the soil-fertility is built up enough, species such as brown-top, Lotus major, white clover, &c., readily penetrate the broken crown and thus help to smother the ratstail out all the quicker. Some very good examples of ratstail-control by manuring and harrowing may be seen on the main Awakino Valley Road, where paddocks only lightly stocked, unharrowed, and unmanured may run dominantly to ratstail, while adjoining paddocks well farmed are comparatively free of this grass.

It is on the unploughable, unmanurable hill country—land that has been under beech forest (where the climate is warm enough), poor kamahi, rewarewa, tanekaha, and hinau spurs, &c., poor light soils, fluffy soils, pumice sandhills, and coastal scrub country—that ratstail undoubtedly has a place.

FIG. 144. RELATIVELY STRONG BROWN-TOP AND LOTUS MAJOR COMPETING WITH RATSTAIL ON MR. BERNARD CHAMBERS'S ESTATE, MOKAU RIVER.

By top-dressing, and promoting a vigorous growth of the better grasses and clovers, ratstail may be quite kept in check and ultimately eliminated from the sward. Tripod harrowing helps materially in this work.

FIG. 145. RATSTAIL AND LOTUS MAJOR ON MR. CHAMBERS'S MOKAU COUNTRY.

The presence of a clover working in with the ratstail increases greatly the value of the sward. In the wetter country Lotus major acts well as a companion to ratstail, and on the dry east coast country subterranean clover, suckling clover, clustered clover, striated clover, &c., work in well with ratstail, provided its growth is not allowed to become too rank.

[*Photos by E. Bruce Levy.*

SOWING OF RATSTAIL.

The fine reddish seeds of ratstail are extremely slow to germinate under average field conditions in New Zealand, and even under artificial conditions in the seed-testing laboratory high germination tests are never secured. Where germination has taken place establishment is extremely slow. In experimental sowings made in Taranaki three and four years ago, only a few plants are now visible in the turf. On warmer country, however, establishment is more rapid. On the lighter fluffy soils, owing to the tough nature of the herbage, loss of plants through stock-pulling is often high. The principle of sowing only small amounts of seed of extremely slow establishers is adhered to in the case of ratstail; ½ lb. to 1 lb. of seed per acre included in the mixture affords establishment of a few plants, and reliance is then placed on these reseeding and in the course of time filling up and thickening the turf through shed seed.

Ratstail seed is often difficult to secure, merchants to a very large extent having ceased to handle it, owing largely to depreciatory propaganda mitigating against the demand. It seems to be very desirable that merchants operating over country such as here specified should carry stocks of ratstail-seed and recommend it for the special soil-type and conditions appertaining to the poor hill and coastal country of both Islands. Ability of the holder to manage his country right should, however, be expressly taken into consideration.

CONCLUSION.

There is no doubt that ratstail has a place on the soil-types here defined, and the recommendation of practical men such as Mr. Guthrie-Smith, Mr. Bernard Chambers, and others should go far to allay the general unwarranted condemnation that is abroad in the minds of pastoralists, seed-merchants, and agricultural advisers in general.

(Series to be continued.)

THE RABBIT NUISANCE.

THE section on the rabbit nuisance in the annual report of the Live-stock Division for 1927–28 is introduced as follows :—

The improvement in the state of the rabbit pest recorded last year has been more than sustained, and the rabbit population to-day is considerably reduced. This refers particularly to areas which were previously known to be badly infested. In some parts of the Auckland District where the season was favourable rabbits began to show up where previously, although their presence had been known, they had not shown any tendency to increase, and energetic measures had to be taken. To maintain the position now attained constant vigilance will be necessary both by the settlers and the Inspectors, as any slackening will quickly be reflected in increased numbers of the pest. To Rabbit Boards a full measure of credit for the improved position is due. The Boards constituted have, almost without exception, justified their existence, and the manner in which they have approached the matter and co-operated with the Department has been an inspiration, and deserves the recognition of the Department and the country as a whole. Increased production would have been an impossible task in some districts without an energetic campaign against the rabbit, and the increased sheep now carried is evidence of the success attained. The total amount in subsidies paid out to Boards during the year under the provisions of the Act was £15,300.

BOVINE PARTURIENT ECLAMPSIA.

C. V. DAYUS, M.R.C.V.S., Veterinarian, Live-stock Division, Hamilton.

CONSIDERABLE publicity has been given of late to a condition occurring in dairy cows, from which there has been some mortality in certain of our dairying districts. It has frequently been referred to as "a new mysterious disease." The condition is probably well described under the name of bovine parturient eclampsia—"parturient" because of its association with advanced pregnancy and the after-calving period, and "eclampsia" as conveying some idea of the serious nervous disturbances generally found associated with the condition.

HISTORY.

There is nothing really new about the trouble. Cases have occurred from time to time for some years past in various parts of New Zealand, but it is by no means a disease confined to this country. I have observed identical cases in England. It is admittedly rarer in the British Isles, probably due to the fact that dairy cows there are housed during the autumn and winter months, and are not at pasture.

In order to immediately allay the fear of some dairy-farmers it may be stated that there is no reason to suppose that the condition is in any way contagious or infectious—no more so, in fact, than is the erroneously termed condition "milk-fever," with which most farmers have had at least a little experience.

It is possible for cases to occur both before and after calving, the latter being by far the more common. Cases have been brought to my notice as long as a fortnight before and six weeks after calving. In this country the condition is practically confined to the period from the middle of July to the end of September. It occurs chiefly in cows that calve at the full normal period of gestation, usually without difficulty, and also in those in which the afterbirth is seldom if ever retained.

CAUSE.

The cause of the condition is not known, but there are some interesting points in this connection worthy of mention. Hitherto "sepsis"—by which term is meant a septic infection of the womb—has often been supposed in this country to account for the condition, but, in my opinion, there seems nothing whatsoever to support this. Such a view fails to explain the cases that do occur before calving, is inconsistent with a subnormal temperature, and does not account for the seasonal period during which cases occur. Furthermore, the cases occur in those cows which one would be substantially correct in presuming the least likely to be subject to any such infection—that is, they are neither aborted animals nor those in which the afterbirth has been retained.

Like a somewhat similar condition in the human subject at the same critical period, and of which the cause is equally unknown, bovine parturient eclampsia appears to be an acute toxæmia. A toxin

or poison, probably of a complex nature, circulates in the blood, profoundly affecting the nervous system and the cardiac and respiratory centres in the brain. There are fairly constant pathological lesions in various organs in affected animals, and these certainly to some extent offer support for this view. But although there are toxins of pregnancy, they do not entirely account for the cases in question, otherwise veterinary literature in other countries would abound in information on the subject in bovines, whereas any references are very meagre.

It would appear that, largely owing to the demands of pregnancy and more particularly the onset of lactation, the animal's natural resources are taxed beyond physiological limits, and that as a result there is an upset in the mineral balance, which, when normal, exerts some controlling influence over the production, absorption, and elimination of the ordinary toxins, whether of pregnancy or from dietary sources.

Every effort is made in farm management to retain the natural feed during the late autumn and the winter period, but owing to various causes this herbage often tends to become sour and rank and its mineral content changed. If cows are on poor pasture and actually short of feed, they may show the undesirable consequences of under-nutrition, but they do not appear to suffer from this disease. At the same time any high condition of the cow is not solely responsible, for if this is maintained by a balanced ration made up of good feed, such as first-quality hay, ensilage, roots, or any concentrate food as linseed-meal, bran, &c., she still does not appear to suffer.

W. A. Henry and F. B. Morrison, in their book "Feeds and Feeding," state: "Possibly the milk-producing capacity of our dairy cows has been so increased by selective breeding that it exceeds the ability of high yielding cows to assimilate sufficient mineral nutrients from their feed to meet the heavy demand in producing the large flow of milk during the first part of the lactation period. Later on in lactation, or when they are dry, it is found that they are able to build up again the stores of these mineral constituents in their bodies, if fed plenty of good legume hay." This statement is of further interest inasmuch as dry cows or steers feeding under the same conditions do not become similarly affected.

When there is a seasonal change to spring conditions the risks of any losses are practically eliminated.

SYMPTOMS.

While cases occur over the period already mentioned, the commonest time to observe symptoms is about fourteen days after calving.

An animal will be noted with a starey fixed expression in her eyes. She becomes very restless and nervously alert. There is a peculiar, almost characteristic, gait; paddling with the hind limbs, sometimes snatching each limb up with a sudden jerk, the front legs progressing with a stiity kind of movement.

Various groups of muscles are in a state of tetany, the animal sometimes becoming violent, shaking all over, and bellowing and frothing at the mouth. The jaws are frequently more or less rigidly closed except for a spasmodic champing movement, the pupil of the

eye is contracted, and as the animal moves its head the eyeballs roll from side to side.

The nervous irritability is often greatly increased by disturbing or approaching the animal. The temperature is below normal.

The animal staggers and falls. On the ground the convulsive movements become more marked; the limbs are semi-rigid and constantly on the move. This makes it somewhat difficult to support the animal in her normal position on her brisket. While down she throws her head about violently, and often dies in convulsions. It is not always, however, that any marked symptoms are observed. With little or no warning the animal may drop and die within a quarter of an hour.

Occasionally spontaneous recovery appears to occur. Again, sometimes the animal is down for two or three days, and the more violent symptoms then pass off; but she finally succumbs to cardiac and respiratory disturbances.

TREATMENT.

It should be sufficiently obvious that any lines of treatment must be from a preventive standpoint; the consideration of curative measures is of far more doubtful possibility.

Of the few essential mineral elements that might be lacking consequent on the demands of pregnancy and lactation, calcium and phosphorus are outstanding. This strongly enhances the importance of a liberal daily ration containing these elements in the maternal diet throughout this period. Dairy-farmers, and especially those who have experienced parturient eclampsia, should allow the following mineral mixture to be available for their animals, both in the paddocks and the shed: Bonemeal, 100 lb.; coarse salt, 50 lb.; potassium iodide, 2 oz.

At calving-time, allowing a little time for recovery from the birth, each cow should be given a drench containing– Magnesium sulphate (Epsom salts), 1 lb.; potassium acetate, ½ oz.; ground ginger, ½ oz.; molasses, ½ lb. And, again, where trouble has been known, this drench should be repeated a week later.

When an animal has become seriously affected care has to be taken in the method of treatment. It is often a danger to drench, for two reasons: approaching and handling the animal increases the severity of the symptoms, and the liquid may pass into the trachea and so into the lungs. If it is possible to drench an animal safely, a sedative medicine with the object of controlling the symptoms should be given, such as 2 oz. of laudanum in a pint of water. There are other and more effective means of accomplishing this if the case is attended by a veterinary surgeon.

In all cases it is wise to carry out the udder-inflation treatment as for "milk-fever," in order to be on the safe side. There can be little harm if the usual precautions are taken. Real effort, in spite of any difficulty, must be made to support the animal in the normal position on her brisket. Many farmers do not appear to realize the importance of this. Further, since the temperature is subnormal, the animal should be covered sufficiently and kept warm.

MINERAL CONTENT OF PASTURES.

EXAMINATION OF SOME WAIRARAPA DISTRICT SAMPLES.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

A NUMBER of soil and pasture samples from various parts of the Wairarapa district have recently been examined, and others are now being analysed with the objective of determining whether any mineral food is so lacking as to injuriously affect the yield from and health of domestic stock. The results already obtained are important enough to warrant publication without waiting for the completion of the analyses. These will take some weeks longer and probably not add materially to the existing facts, whereas the early distribution of the present information may do much to warn the farmer against the possibilities of the coming summer season.

The samples were collected by Mr. C. M. Wright, country analyst under the Mineral Content of Pastures Research Scheme, and were carefully selected from a number of farms in the course of a somewhat hurried preliminary tour of the district in February, 1928. It was noted that most of the pastures presented a dried-up appearance on account of the very long dry spell of weather then experienced, but some of the pastures were green and in good heart. Mr. R. E. Grimmett visited the same district in September, 1928, and collected some further samples of pasture.

THE SOILS.

Briefly, it may be said that the analyses indicate a somewhat varied range of composition for the Wairarapa lands. This is as might be expected, when it is remembered that the materials of which the soils are composed have been derived from the greywacke rocks of the Tararua Mountain Range, the Tertiary rocks of the eastern ranges (Puketoi Hills, &c.), and from the Mauriceville limestone area; that the rivers carry down large quantities of silt and occasionally flood the lower Wairarapa lands, adding another complication, the deposition of river-silt; and that some of the country consists of flax and other swamps supplying soils with a high organic-matter content.

Texture: By the mechanical analysis it was found that the soils of the district vary from loams to fine sandy loams and silty loams, the addition of the adjective indicating that the loam is mixed with a larger amount, in the one case of fine sand, or in the other silt, so as to cause a deviation from the first-named type. In the case of the swamps, the soils will be largely the so-called humus or organic-matter type. There is nothing to take exception to in these mechanical results. The loams belong to a type which furnishes the most fertile soils of the world, and the dilution of a loam containing, say, 15 per cent. of clay with some additional fine sand or silt would improve the loam soil for many purposes.

LIME-REQUIREMENT.

The soils under consideration manifest a great diversity in their demands for lime, as indicated by the calcium content of the soil, the

sourness of the soil measured by the hydrogen-ion concentration (*p*H figure) and by the Hutchinson and Maclennan method for determining the absorbable calcium carbonate ("lime-requirement" figure). The "humus" soils derived from drained swamp-lands are, of course, entirely exceptional in their requirements and characters, and cannot be considered by the standards in use for judging ordinary soils. But apart from these there is only one sample which shows an extraordinarily high lime-requirement, a silt-loam from Hukanui which would require 6½ tons of carbonate of lime per acre to satisfy its requirements fully, the lime-requirement figure being 0·65 per cent., with a *p*H figure of 5·2. Other samples from Kaituna, Hamua, Featherston, and Belvedere show the not unusual lime-requirement figures of from 0·3 to 0·4 per cent. calcium carbonate, with a *p*H figure of 5·3 to 5·8. A sample from Mauriceville gave a negative lime-requirement figure, it being slightly alkaline in action, having a *p*H figure of 7·5, and containing 3·24 per cent. of calcium oxide (lime) soluble in strong acid.

Thus there are in the Wairarapa a range of soils varying largely in their demands for lime--from the slightly alkaline, which require none, up to the subacid, which will take as much as the farmer can afford to apply. The great bulk of the soil would appear, however, to be no worse off for lime than the majority of North Island fertile lands, and the question whether the deficiency of lime in the soil is sufficient to cause serious concern must be examined in the light of the composition of the pasture.

CHEMICAL ANALYSIS.

The chemical analysis of the soils provides the first really disconcerting evidence as to deficiency. In some areas where dairying is carried on the soil is decidedly low, both in available and in total phosphoric acid (for example, at Kaituna, Mauriceville, Hamua, and Hukanui), and every one of the ten samples analysed is low in total phosphoric acid, and three out of the ten are very low. The Kaituna soil is apparently the worst, with only 0·003 per cent. available and 0·02 per cent. total phosphoric acid, and containing only 0·32 per cent. of lime (CaO); while the best soils are apparently those at Featherston, which have 0·014 to 0·016 per cent. of available, and 0·04 to 0·08 per cent. of total phosphoric acid, and a lime content (CaO) of 0·74 to 1·17 per cent. In between these extremes furnished by the Kaituna and Featherston soils fall the other soils. This is evidence of unusual deficiency of phosphate for dairying lands, and will be substantiated by the results of the pasture analysis.

THE PASTURES.

These consist botanically of agrostis species, and the other so-called English grasses, cocksfoot, rye-grass, crested dogstail, timothy, Yorkshire fog, and clovers, as well as moss and weeds and in the swamps native growths, such as rushes—the various species displacing each other according as the environment becomes more suitable to one group of pasture plants than another. A remarkable fact in the botanical composition is that there appears to be no paucity of white clover on any of the land, even the poorest.

It is when one comes to the chemical composition of the samples that the remarkable fact is disclosed that samples of these cow pastures collected in February in several localities yielded such low amounts of phosphoric acid as to place the samples among the lowest recorded in New Zealand for phosphate content. Regarding the other necessary minerals—calcium (lime), magnesium, chlorine, manganese, sulphur, &c., there is no evidence of any deficiency. The lime content of the pastures—as one would expect from the fact that the pasture contained a good proportion of clovers—is high, even on the paddocks untreated by any phosphate or lime dressing. Thus the lime varies from 0·9 to 2·0 per cent. on the dry matter, whereas the phosphoric-acid content (P_2O_5) of these untreated pastures of Kaituna, Hamua, Hukanui, and Belvedere farms is exceedingly low, the percentage varying from 0·19 to 0·26. Even the areas top-dressed with phosphate only show from 0·35 to 0·48 per cent. Some of the richer lands, especially those at Featherston, show slightly higher figures—0·56 and 0·64 per cent. The latter figure was the highest reached on any of the pasture samples collected in February. There is evidence that this low phosphate content may have been partly due to a seasonal cause, as drought is known to affect the phosphate content of the pasture more than the lime or other mineral content. A sample of pasture collected in February from the Kaituna farm gave 0·19 per cent. of phosphoric acid. This farm was again visited in September, when a sample taken gave 0·45 per cent. phosphoric acid. That the phosphoric content of pasture may sink to as low an ebb as 0·19 is, however, a very serious discovery, and means that if this is a usual occurrence in the dry months of summer steps must be taken to correct the mineral content of the cows' rations by supplementary feeding with phosphate licks or pellets, or food having a much higher phosphate content than the pasture.

The average cow would not ingest daily a greater amount of pasture than would be equivalent to 21 lb. of dry matter. The worst Wairarapa district pasture in February contains, say, 0·2 per cent. phosphoric acid, which means that the cow would consume only 0·042 lb. phosphoric acid, an insufficient amount when one considers that only one-third to one-half of it (or less than 0·02 lb. P_2O_5) is digestible, whereas the cow requires of phosphoric acid for maintenance 0·018 lb., for the unborn calf 0·009 lb., and for every gallon of milk produced 0·018 lb., making a total of 0·045 lb., or more according to the yield of milk and physiological condition of the cow.

CONCLUSIONS.

The lesson to be learned from the investigation, so far as it has gone, is that phosphoric acid is the deficiency which must be acted against in the poorer pastures of the Wairarapa. Dry seasons are likely to accentuate considerably this deficiency. It is possible that even when the soil contains enough phosphate for ordinary seasons an exceptionally dry one will necessitate supplementary feeding with rations of high phosphate content, or with a mineral lick or medicine containing phosphates. More work is required to be carried out on the examination of the pastures at different seasons of the year, and a reconnaissance soil survey of the lands is an essential requisite before one can say how far the results for one type of soil hold good for an entirely different type.

TURNIP-MANURING INVESTIGATIONS.

REVIEW OF RECENT EXPERIMENTS AND OUTLINE OF FUTURE WORK.

A. W. HUDSON, B.Ag., B.Sc., Crop Experimentalist, Fields Division.

THE object of this article is not to discuss results of turnip-manuring experiments in detail, but merely to indicate some of the salient features and lessons resulting from investigations which have been in progress for a period of four seasons. The initial experiment of those under review was conducted on the farm of Mr. R. S. Gunn, Darfield, in the 1924–25 season, by Mr. F. E. Ward (now Director of Agriculture in Tasmania) and the writer. Since that time a gradual extension of the work has been made possible, and in the present season (1928–29) it is intended to conduct on turnips and swedes from fifteen to twenty trials throughout Canterbury, some ten to fifteen in Otago and Southland, and one or two in Auckland.

In the light of knowledge gained it has been necessary to modify the scheme of work which it was originally intended to pursue. The reason for this will be apparent when the factors influencing the field germination and yields under different manurial treatments are discussed.

METHODS OF SOWING.

Following the usual Canterbury practice, the manures and seed have been sown in 14 in. rows on the flat, the manure and seed mixing in the course of the fall from their respective boxes through tubes and coulters to the ground. Unlike the European practice of "manuring the ground" before sowing the seed, or our Southland practice of using a ridger which places most of the manure below the seed, the Canterbury method brings all the manure and seed into intimate contact in the soil. It is this close contact between seed and manure which sets up complications.

MANURES UNDER TRIAL IN EARLIER EXPERIMENTS.

Superphosphate, Ephos phosphate, and Nauru phosphate are the phosphatic fertilizers which have been under trial. They have been used at 1 cwt. per acre alone, and in mixtures of super + Ephos and super + Nauru. It very soon became evident that raw Nauru phosphate was quite unsuitable for Canterbury conditions, although mixed

Table 1.

Season.	Yield in Tons per Acre.		
	Superphosphate.	Ephos.	Difference in Favour of Superphosphate.
1924–25	17·5	15·5	2·0
1925–26	15·5	14·7	0·8
1926–27	20·1	11·9	8·2
1927–28	11·1	6·8	4·3
1927–28	17·5	13·0	4·5

with super it gave very fair results. Ephos alone gave quite good results for the first two years, but subsequently the results showed quite conclusively that it was not nearly so efficient as super, although the mixture of the two proves to be practically on a par with super. Table 1 indicates the relative merits of super and Ephos so far as yield is concerned. These results are from experiments carefully conducted in the Malvern, Selwyn, and Levels Counties.

EFFECT OF MANURES ON GERMINATION.

That superphosphate sometimes reduces field germination is well known to farmers, but no information as to the extent of this reduction was available. In the second year of the experiment it was decided to endeavour to measure the relative germination of the differently manured plots. (Note.—The method adopted (see photo) is to take counts, in sixty to one hundred places, of the number of plants falling within a row length of 10 ft. in a single row on each treatment. Plots are seeded at the same rate, and the same coulter row is counted on every plot. If plots of each treatment are repeated ten times from six to ten counts are made in each plot. To ensure a high degree of accuracy it is found that sixty is about the minimum number from which the average should be calculated. The counting is usually done about three or four weeks after sowing.) The seeding was about 9 oz. per acre, and the average numbers of plants in 10 ft. of a single row were as follows for three of the treatments :—

(1) Ephos, 1 cwt. per acre	21·7
(2) Super, ½ cwt. + Ephos ½ cwt.	18·9
(3) Super, 1 cwt.	14·6

Regarding Ephos as 100 per cent., the treatments (2) and (3) germinated 87 and 67 per cent. respectively.

This relationship of kind of manure to germination has been remarkably consistent over a period of three years, and subsequent experiments in which "no-manure" plots have been sown show about the same germination relative to super as does Ephos. All results indicate that Ephos, Nauru, and other similar raw phosphates have no adverse effect on the germination of turnips, whereas superphosphate sown at the rate of 1 cwt. per acre in 14 in. rows gives a germination of about 65 to 75 per cent. of what could be expected when no manure or a slow-acting phosphate is used. If the quantity of super is increased to 2 cwt. per acre in 14 in. rows the germination under the same conditions is usually reduced to 40 to 50 per cent.

Several experiments in which from ½ cwt. to 2 cwt. per acre of super has been used show a regular reduction in number of plants as the quantity of manure is increased. In spite of this adverse initial effect, super at *1 cwt. per acre*, in Canterbury, is undoubtedly as good a phosphatic manure as can be used. The same cannot be said when the quantity in contact with the seed is increased, as is often the case on heavy lands and those blessed with a higher rainfall, which generally occurs along the country in close proximity to the mountains. Under these conditions some means of supplying extra phosphate is desirable ; but if it is extra *superphosphate* it must be applied in such a way as not to be in direct contact with the seed.

TAKING GERMINATION COUNTS OF TURNIPS BY PLANTS.

A 10-ft. rod is placed at random in sixty to one hundred places in each manurial treatment, and the plants falling within the rod's length are counted.

WHY SUPER CAUSES GERMINATION INJURY.

Super is the only straight-out phosphate commonly used for agricultural purposes which is soluble in water: consequently when it is put into the soil a certain amount of it dissolves immediately and gives what is comparable to brine. A weak brine is of little use in "pickling" pork, and consequently a lot of salt has to be used in a comparatively small amount of water for successful pickling. A heavy dressing of super concentrated in a small space in the soil produces a comparatively "strong" solution about itself, with the result that the seed, or the young plant, if the seed ever germinates, is "pickled." The effect is usually referred to as "burning (technically the process is known as plasmolysis)." The drier the soil the worse the effect, because there is less water to dissolve the super. It must not be thought that a dry soil is the only one in which superphosphate injury occurs. As a matter of fact, seed-injury takes place, as indicated above, under ideal moisture conditions at the time of sowing. The bad effect is lessened if rain falls during or immediately after sowing, but this often results in poaching of the ground and a bad strike in any case. Injury caused by excessive quantities of super persists for some time after the plant comes through the ground, and is shown by a yellowing, stunted, and starved appearance of the young plants, which may recover as time goes on.

HOW EXTRA PHOSPHATE MAY BE ADDED TO A BASAL QUANTITY OF SUPER WITHOUT FURTHER GERMINATION INJURY.

The following methods apply under this heading :—

(1) By adding to an initial quantity of super some slow-acting phosphate such as Ephos, basic slag, or Seychelles. This practice is to be

recommended when the total quantity of manure used exceeds 1 cwt. per acre. Up to 1 cwt. per acre of super alone is just as good as or better than the mixture.

(2) By drilling super into the soil a day or two before sowing the crop. Experiments carried out for two years have shown that as much as 2 cwt. per acre "pre-drilled" in this way will not affect the germination of the seed sown afterwards. The pre-drilling should be done through every coulter of the drill, and at right angles to the direction it is intended to sow the seed. The method has a good effect on yield on land capable of responding to heavy dressings of phosphate. From ½ cwt. to 1 cwt. per acre should be sown with the seed on top of the super pre-drilled.

The following crop-yield results were obtained on Mr. R. J. Low's farm, at Methven, in 1927–28, from the use of super :—

	Tons per Acre.
(1) ½ cwt. with seed in 14 in. rows	16·1
(2) 1 cwt. pre-drilled + ½ cwt. with seed	25·3
(3) 2 cwt. pre-drilled + ½ cwt. with seed	29·4

And using 1 cwt. super with seed in 14 in. rows the yields were as follows :—

	Tons per Acre.
(4) 1 cwt. with seed in 14 in. rows	20·1
(5) 1 cwt. pre-drilled and 1 cwt. with seed	26·6
(6) 2 cwt. pre-drilled and 1 cwt. with seed	30·0

On Mr. H. Ruddenklau's farm at Waimate the yields under the foregoing treatments (1), (2), and (3) were 13·7, 16·5, and 18·8 tons per acre respectively. With treatments (4), (5), and (6) the yields were 13·7, 14·5, and 14·7 tons per acre respectively. In this experiment the germination as a whole was bad, and of course was worse on the plots having 1 cwt. super with the seed than where only ½ cwt. was used. The failure of treatments (5) and (6) to give a good response to the extra phosphate may be due to the fact that too few plants were present for securing full utilization of the extra manure applied. In this experiment treatments (1), (2), and (3) had an average of 9·8 plants per 10 ft., while treatments (4), (5), and (6) had 7·7 plants in the same distance.

(3) A third method of supplying extra superphosphate is to drill the manure across the rows after the crop has been sown and when the leaves have grown to about 3 in. to 4 in. long. This is referred to as "post drilling." The drill coulters pull out very few turnips, and it is probable that the cultivation given is extremely beneficial to the crop. No exact yield figures are available to indicate the value of this method, but a good deal of observation of farmers' results indicates that the method is a very good one.

(4) A fourth method which has been put under experiment is that of sowing the manure through every coulter, and the seed as usual through every second coulter. Thus half the manure applied is with the seed and the other half between the seed-rows.

At Methven the following results were obtained last season :—

	Tons per Acre.
Super, 1 cwt. in 14 in. rows (seed in 14 in.)	20·1
Super, 2 cwt. in 7 in. rows (seed in 14 in.)	27·0

At Waimate there was no difference in yield between the two treatments.

(5) Another method which should be tried by farmers is to sow seed and manure through every coulter of the drill. When sowing on the flat the general practice, except in South Canterbury, is to sow in 14 in. rows. Apparently this method is a relic of the practice of sowing on ridges or in wide rows and intercultivating. 14 in. rows are practically never intercultivated, and it is certain that the same amount of seed and manure per acre would result in a more uniform and better strike in 7 in. rows than in 14 in. rows. This should result in a better yield. 1 cwt. of manure per acre, sown in 7 in. rows, gives only half the amount of manure in contact with the seed that is given by 1 cwt. in 14 in. rows. Hence the soluble and efficient super is less likely to injure germination.

A trial was conducted at the Ashburton Experimental Farm last year to test germination and yield, and bore out the foregoing contention. 9 oz. of seed per acre in 14 in. rows gave *nine* plants per 10 ft. row of 14 in. 9 oz. of seed in 7 in. rows gave *fourteen* plants per 10 ft. × 2 rows of 7 in. 1 cwt. of super was used in both cases and sown in the seed-rows only. The 7 in. row sowings yielded 16·8 tons per acre and the 14 in. row sowings gave 15·3 tons per acre, an increase of 1½ tons per acre. When the seeding on the 7 in. row plots was increased to 13½ oz. the yield given was 17·6 tons per acre.

(6) A sixth method, which is giving promising results, is that of mixing carbonate of lime with superphosphate in equal parts. Manure-mixing charts indicate that the two substances should not be mixed. In practice the mixing gives excellent results by reducing the germination injury without any apparent serious reduction in the efficiency of the phosphate.

In an experiment on Mr. W. J. Jenkins's farm, at Sheffield, 1 cwt. super + 1 cwt. carbonate of lime (2 cwt. per acre) gave a 50 per cent. better germination than 1 cwt. of super, and an increase in yield of 3½ tons per acre. 2 cwt. super + 2 cwt. lime (4 cwt. per acre) gave the same germination as the mixture at 2 cwt. per acre, with a further increase in yield of 5·2 tons per acre, or 8·5 tons better than 1 cwt. of super.

Hence 2 cwt. of super per acre when mixed with an equal amount of carbonate of lime can be used with safety, although 2 cwt. of super alone would seriously impair germination. Farmers should try this method, keeping in mind the fact that the amount of super per acre must not be reduced below that commonly used. Lime will not serve as a substitute for phosphate.

CONDITION OF COULTER-TIP AND ITS EFFECT ON GERMINATION.

It is generally conceded that the ordinary grain-coulter with a tip so worn as to have an almost square end is the best for sowing turnips, for the following reasons: (1) It does not penetrate very far into a well-packed soil, and therefore the seed is not buried too deeply; (2) it drags a comparatively broad furrow, which enables the manure to be spread a little, thus bringing less into intimate contact with the seed.

For the purpose of making a comparison between the turnip-coulter with the wedge-shaped tip, the grain-coulter with a new tip, and the grain-coulter with a well-worn tip, a trial involving the use of all these

types was carried out at the Ashburton Experimental Farm last year. Super at 1 cwt. per acre in 7 in. rows was used with 9 oz. of seed per acre. About two hundred counts were made on rows sown with each coulter type, with resultant germination in the following ratios: Grain-coulter with well-worn tip, 100; turnip-coulter with wedge-shaped tip, 93; grain-coulter with new tip, 82.

EFFECT OF SUPERPHOSPHATE ON GERMINATION IN DISTRICTS OF HIGHER RAINFALL AND WHERE RIDGING IS PRACTISED.

It is sometimes argued that bad effects such as those experienced in Canterbury do not occur in districts of higher rainfall. That this contention is incorrect may be seen from the results of counts taken on plots of a manure trial conducted at the Gore Experimental Area last season (see *Journal*, August, 1928, p. 120). The crop was sown in twenty-six ridges, and all manures were applied at the rate of 2 cwt. per acre— 1½ cwt. being sown from the front box of the ridger and deposited about 3 in. below the seed, and ½ cwt. per acre from the rear box. The latter fell with the seed.

Super and five slow-acting phosphates were used in the trial. The adverse effect of too much super in contact with seed was apparent in the early stages of growth, and counts showed that the germination of the super plots was 70 per cent. of that of the slower-acting phosphates, which latter did not differ from one another. This figure is in very close agreement with that stated for Canterbury conditions when 1 cwt. is sown in 14 in. rows (½ cwt. in 26 in. rows is approximately the same per row as 1 cwt. in 14 in. rows). Hence the problem of overcoming injury by super is just as important in higher-rainfall districts as in Canterbury.

THICKER SOWING WILL NOT COMPENSATE FOR GERMINATION INJURY.

An increase in the rate of seeding will not satisfactorily compensate for injury to germination. Injury to germination causes a patchy crop, and increased seeding will not lessen the patchiness but will rather accentuate it by giving too many plants where injury has not occurred; and where ridging is practised a thickly seeded crop is difficult to thin evenly.

MIXING SEED WITH MANURE.

This practice is very common, because often farmers have no special drill attachment for sowing small seeds. It can be quite safely carried out with slower-acting phosphates such as Ephos, slag, &c., but if superphosphate is being used a matter of three to four hours' immersion of seed in the manure will generally ruin field germination entirely. Hence if the practice is adopted sowing must be done immediately after mixing.

FUTURE RESEARCH.

The programme of work outlined below shows that all the methods of manuring discussed in this article are being further investigated, and it is hoped that within the comparatively near future definite and conclusive results will be at the disposal of farmers.

Type of Investigation.	Location.
(1) Super in competition with super and lime in different proportions	North, Mid, and South Canterbury.

Type of Investigation.	Location.
(2) Super plus lime in competition with super plus a slower-acting phosphate	North, Mid, and South Canterbury; Southland; Auckland.
(3) Super plus lime mixed for varying periods before sowing	North, Mid, and South Canterbury.
(4) Sowing in 14 in. rows in competition with sowing in 7 in. rows	North and Mid Canterbury; Auckland.
(5) Pre-drilling, post-drilling, and inter-row drilling of extra phosphate	North, Mid, and South Canterbury.
(6) Trial of soluble nitrogen as addition to phosphate	North, Mid, and South Canterbury.
(7) Trial of varying quantities of super, super plus lime, and super plus a slower-acting phosphate in contact with and below seed in ridge-sowing	Southland.
(8) Trial of phosphate, nitrogen, and potash in ridge-sowing	Southland.
(9) Trial of swede varieties to determine yield, keeping-quality, palatability, &c.	Otago.

This work is being conducted by the Department's Instructors in Agriculture in their respective districts.

MORTALITY AMONG SHEEP FOLLOWING DIPPING.

EXPERIENCE IN CANTERBURY.

E. J. LUKEY, B.V.Sc. (Melb.), Veterinarian, Live-stock Division, Christchurch.

REPORTS of considerable mortality occurring among sheep after dipping were received during last season by the Christchurch office of the Department of Agriculture, covering the whole of the Canterbury District, and it is understood that mortality from the same cause occurred also more or less in other parts of New Zealand. Investigations into the deaths were made by officers of the Department, also in a number of cases by private veterinary surgeons either on behalf of the farmer himself or the firms handling the particular dip. These investigations in every case showed that the deaths were due to broncho-pneumonia brought about by the dip-fluid entering the lungs.

My own investigations, in which I was assisted by Mr. F. Mackenzie, Principal Inspector, and Mr. J. W. Smith, Inspector of Stock, were confined chiefly to mid-Canterbury, and more particularly to Ashburton County.

In every case inquired into the history showed that the deaths took place between the second and fifth days after dipping. It was also a very noticeable fact that the mortality seemed to be confined more to rams and lambs, and that in practically every case it was with the first dipping of the season and in the first mob dipped that the deaths had occurred; furthermore, two farmers assured me that it was the very first lambs in the dip that had died. The mortality was greatest during January and February, the two hottest and driest months of the year.

The affected sheep bore a very dejected appearance, standing apart from the remainder of the flock, breathing heavily, and with their

heads down. In some cases there was a blood-tinged frothy discharge from the nostrils, and in others slight salivation.

Several post-mortem examinations were made of carcasses of sheep that had died, and other sheep showing symptoms were slaughtered and examined. The abdominal organs appeared normal to the naked eye, except in a few cases where the abomasum (fourth stomach) showed distinct patches of acute inflammation, the œsophagus (gullet) in these cases also showing similar lesions. The lungs in all cases were in a hepatized condition—that is, a condition resembling a liver. The mucous membrane lining the trachea and bronchial tubes (air-passages) were acutely congested, and in many cases the lungs were of a purple-black colour. There was a frothy blood-tinged exudate in the trachea. In several cases there was an acute inflammation of the larynx, giving indication of having been caused by some strong irritant. The whole picture was one of broncho-pneumonia.

Pneumonia may follow dipping in two ways: First, merely as a result of chill and loss of vitality following dipping under unsuitable conditions, of which common instances are shown when lambs are dipped late in the afternoon and are not dry at nightfall. In such case, if after sundown the temperature of the air falls quickly, and especially if there is a strong cold wind, there is a great probability that a number of lambs will succumb to pneumonia. The same risk attaches to dipping adult sheep, but in a lesser degree. The second cause of pneumonia, and by far the more common of the two, is the accidental aspiration of the dipping-fluid into the lungs of the sheep. This is known as traumatic pneumonia, and was the condition met with during our investigations.

But why was the mortality greater this year than in other years? This is a natural question which the farmer should and did ask.

In some cases the sheep had been yarded overnight; in others they were in a paddock adjoining the dip; and, again, others had been driven through several paddocks and even distances along the road. Was the dip at fault? Many farmers thought the strength of the dip had been altered; but against this, as far as we know, every known liquid or paste dip on the market was reported as having been used. One farmer using a particular dip which will be called "A" had losses. He then changed the dip and used what may be termed "B" with good results. A little farther away another farmer used "B" dip and had losses, so tried "A" with good results. Again, in one case where eighty lambs were dipped, twenty-eight died, although the following day one thousand sheep were put through the same dip with only one or two deaths, which were in all probability due to weakness. The dips themselves as a cause of the trouble must therefore be eliminated from the case.

The term "non-poisonous" as applied to carbolic or cresylic dips is a misstatement of fact, and in most countries these dips must by law be labelled "poisonous" and be treated in the same way as other poisons. All these dips contain the coal-tar product "phenol" and other oils which are not very soluble in water, and therefore need some emulsifying ingredients which the manufacturer adds. The manufacturer gives advice as to the best way to mix and use the dip, and such directions should be strictly observed. Hard or brackish water destroys

or renders inactive the soap present in fluid dips, with the result that the emulsion is broken up and the acids and oils are liberated. The effect of this is that when these acids and oils are inhaled pneumonia supervenes, usually with fatal results, and this is what occurred in the cases under review.

I am of opinion that there was a combination of causes to bring this about :—

(1) The summer being dry the water was possibly not as soft as usual, and in the absence of rain most of the water in the races came from springs. I had one lot of race-water analysed, and although it proved to be soft there was evidence afterwards that rain had fallen between the time of the fatal dipping and the time the sample was taken. Mortality was not general, but occurred in patches where the sources of the water-supply were similar.

(2) Apart from the water, the dips were mixed in various ways and were not always formed into a proper emulsion before putting into the bath. The phenols and oils would float to the top, and the sheep on rising to the surface would be more liable to inhale them into the lungs, which in fact did happen.

(3) Sheep driven straight in off the paddocks and dipped on a full stomach would be more liable to inhale the fluid than sheep with empty stomachs. This occurred in some cases.

(4) Numerous rams which died were in high condition ready for the season. Such animals always require special care in the dip.

In conclusion, all farmers may be advised to take the following precautions when dipping :—

(1) Do not dip sheep while they are in a heated condition, nor heat them up by driving after dipping.

(2) If the water is hard, soften it by adding 2 lb. washing-soda to every 100 gallons of water.

(3) Follow directions given with the dip and mix it overnight, stirring again before using.

(4) Avoid dipping the sheep on a full stomach.

(5) Take time, and do not rush the sheep through the bath.

(6) Use the crutch yourself.

(7) Remember that dirty-woolled sheep means soiling of the dip, thereby weakening it and rendering it more or less inert, with the result that the sheep are not properly treated—which may result in their being "ticketed" at the sale-yards.

(8) Run off the dip-fluid after dipping is finished.

(9) Put fresh water in the dip and run it off again before the first dipping of the season.

Insects for Noxious Weeds Control.—The annual report of the Research Department for 1927–28, dealing with this matter, states: "Owing to the unusually bad summers experienced in the North Hemisphere, unforeseen difficulties have been experienced in the direction of securing adequate supplies of many of the insect species required. In particular this has affected work on the blackberry control research, and the tests carried out have been made with limited supplies of insects. Steps are being taken to avoid a recurrence of this shortage by arranging for further supplies to come from Southern Europe, where climatic conditions are more equable."

POTATO-CULTURE.

DESCRIPTIONS OF SOME OF THE MORE IMPORTANT VARIETIES.*

(Continued.)

J. W. HADFIELD, H.D.A., Agronomist, Fields Division.

Sutton's Supreme and Aucklander.

The variety Sutton's Supreme is not obtainable now in England, and is probably almost extinct in this country also. Certainly it is not grown commercially. The two Aucklanders—Short-top and Tall-top—have been grown and sold as Sutton's Supreme for a number of years. The Aucklander is a valuable New Zealand production, and the writer is indebted to Mr. A. J. Rich, of Kaiapoi, for the following historical facts.

For some years prior to 1900 Mr. James Wright, of Coutt's Island (Eyre County), was growing Sutton's Supreme on contract for a firm in Auckland. The popularity of the variety amongst growers waned on the introduction of Northern Star, which produced an abundance of seed and commanded at the time as high a price as Sutton's Supreme or any other early variety.

Sutton's Supreme always produced a number of tall late plants, however carefully the seed was picked over. Mr. Rich first observed these in 1907, and obtained some selections in 1908. The late Mr. Matthew Laws had been working for Mr. Wright and had also noted the rogues. During 1907 and 1908 he worked for Mr. Rich, and it was Mr. Laws who suggested that Mr. Rich should peg out some of these rogues, which showed increased cropping-power and were conspicuously blight-resistant. Two years later Mr. Rich had 4 tons of this variety, which is now grown under the name of Short-top Aucklander. The name Aucklander was given by Mr. Laws. At this time Mr. Rich took over another farm, and Mr. Laws took a cottage nearby. Mr. Laws had become quite enthusiastic over the possibilities of the new selection, and was always on the lookout for anything distinctive.

About three years later three tall-growing plants, quite distinct from the previous selections, were noted in a crop of Sutton's Supreme. Mr. Rich, Mr. Laws, and another grower each took a plant for further trial. From these plants came the present-day Tall-top Aucklander. Mr. Laws selected quite a number of variations, which were of great interest to himself and other potato-growers in the Kaiapoi district. One Tall-top variety with a very spreading top was grown for some time, but the tubers were too coarse for commercial purposes, and the variety is rarely grown now.

The Tall-top may be distinguished from the Short-top by the following characteristics: The Tall-top is taller, the inflorescence is much more prominent, and the flowers more profuse. The Tall-top tubers are not

* New readers are referred to the section, "Scheme of Varietal Descriptions," page 152 of the September issue.

so shapely, and they adhere to the parent plant when the whole shaw is pulled up just before maturity, and when removed tear away, leaving a much larger wound at the point where the stem was attached. The Short-top comes away more easily and cleanly. When mature the Short-top haulms lie flat and are devoid of leaves; in the Tall-top they stand semi-erect and often have attached a number of dead leaves. The Tall-top is about three weeks later than the Short-top, while Sutton's Supreme is distinctly earlier than either of the Aucklanders.

AUCKLANDER TALL-TOP (NEW ZEALAND SUTTON'S SUPREME).

Origin.—See prefatory notes under heading of "Sutton's Supreme and Aucklander."

Habit.—Vigorous, tall, open, and moderately erect and stiff.

Stem.—Wings lightly waved. Colour 2.

Leaf.—Medium dull green; leaflets small and crinkled.

Inflorescence.—Tall and prominent. Flowers white and fairly numerous.

Tuber.—Oval to kidney. Skin creamy-white, clear, and smooth; very thin and easily bruised. Flesh white. Eyes medium to shallow. Sprouts very pale pink.

Maturity.—Early main crop.

NOTES.—A very fine quality potato. One objection is the very thin clear skin, which bruises easily and shows up the least trace of scab. For means of identifying the Short-top from the Long-top see separate notes.

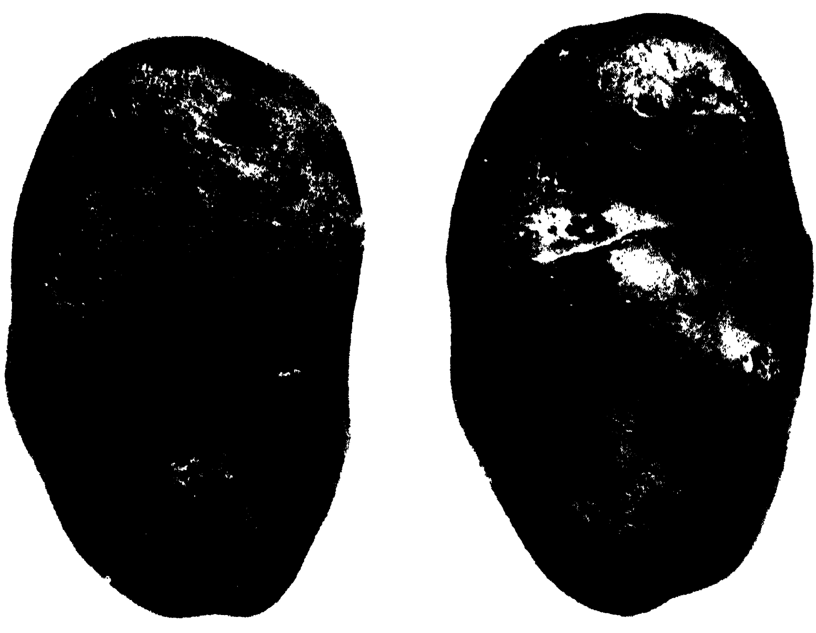


FIG. 8. SHORT-TOP (LEFT) AND TALL-TOP AUCKLANDER.

AUCKLANDER SHORT-TOP (NEW ZEALAND SUTTON'S SUPREME).

Origin.—See prefatory notes.

Habit.—Vigorous, open, medium height, moderately spreading but stiff.

Stem.—Wings slightly waved. Colour 2.

Leaf.—Medium dark green; leaflets small and crinkled.

Inflorescence.—Medium height; flowers white and scanty.

Tuber.—Shape oval to kidney. Skin creamy-white and clear and smooth; very thin and easily bruised. Flesh white. Eyes medium to shallow. Sprouts very pale pink.

Maturity.—Second early.

NOTES.—A very fine quality variety, the one objection being the clear thin skin, which bruises easily and shows the least trace of scab. This variety is probably to be preferred to the Tall-top for North Island conditions. For means of identifying the Short-top from the Tall-top see separate notes.

Northern Star, Gamekeeper, Maori Chief, and Britain's Best.

The mixture which goes under the name of either Northern Star or Gamekeeper has not yet received much investigation. J. Beverley records (this *Journal*, Vol. X, p. 357) that there is a distinction between these two varieties in the flower, and considers it a mistake to deal with them as synonymous. He states that Gamekeeper, which is of New Zealand origin, is a selection from Northern Star. Maori Chief, another New Zealand variety, is also stated to be a selection from Northern Star, and appears similar in all respects, except that the tubers are white splashed with purple.

Britain's Best, a third New Zealand selection, may be classed as a Northern Star, from which it differs very little if at all.

The following description is adapted from British authorities. The writer has failed to obtain a type description constant in all respects, due, no doubt, to the presence of several varieties.

NORTHERN STAR (GAMEKEEPER, BRITAIN'S BEST, AND MAORI CHIEF).

Origin.—Not known, but was introduced to commerce by Findlay in 1900 or 1902, and caused much excitement in Great Britain, being sold for as much as £25 per tuber.

Habit.—Strong, upright, tall, and dense foliage.

Stem.—Wings waved slightly. Colour 0–1, and extending to the midribs of the young leaves.

Leaf.—Dark grey-green. Leaflets small and pointed.

Inflorescence.—Short and inconspicuous. Flowers small, white, and rare; mostly drop before opening. Flower-buds markedly green.

Tuber.—Round. Skin white, moderately rough. Flesh white. Sprouts pink. Eyes medium and deep at rose end. There is a single spot of pink in the eye, most noticeable in the terminal buds, and some pink at the heel end of an immature tuber. Produces numerous long runners and small tubers.

Maturity.—Late main crop.

NOTES.—An undesirable variety for light land owing to the very large number of seed-size tubers produced. On heavy land its cooking-quality is decidedly inferior. It is distinctly disease-resistant, especially to late blight, and is therefore of considerable commercial value in certain parts of the North Island. Northern Star is the most common rogue in the commercial crops of white potatoes in this country.

Maori Chief is a white potato splashed with purple. See separate notes dealing with this group.

FIG. 9. NORTHERN STAR (LEFT) AND BRITAIN'S BEST.

IRON DUKE, OR PRESIDENT.

Origin.—Iron Duke and President are identical. General is a white-flowered President of Dutch origin, introduced into commerce about 1896. The variety is grown in parts of Canterbury under the name of Majestic, to which it is in no way similar. When grown under its proper name it is generally referred to as Iron Duke.

Habit.—Tall, upright, open, and vigorous.

Stem.—Wings waved. Colour 1.

Leaf.—Light green, large and broad.

Inflorescence.—Tall and prominent. Flowers numerous, large, red-purple and distinctly white-tipped. (Compare with Up-to-Date.)

Tuber.—Round to oval. Skin rough and white. Eyes medium. When mature the skin round the eyes shows a pink tinge, but this is not constant and is difficult to observe. Flesh intermediate to white. Sprouts pink.

Maturity.—Late main crop.

NOTES.—A good cropping variety for rich land. Unfortunately all stocks inspected appear to be infected with mosaic.

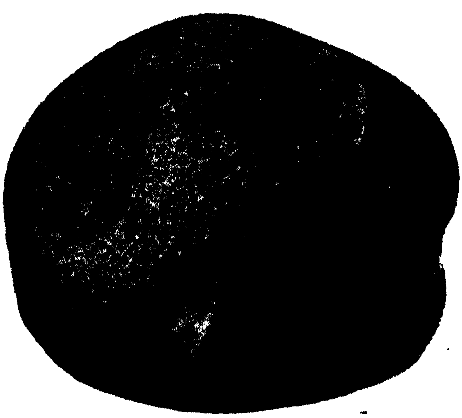


FIG 10. IRON DUKE OR PRESIDENT.

GREAT SCOTT.

Origin.—Raised by G. Mair, of Lockerbie, in 1906, and introduced to commerce by Mr. McAlister, of Dumfries, in 1909. Sefton Wonder is identical with Great Scott, except that the skin of the tuber is russet.

Habit.—Tall, upright, open, and vigorous.

Stem.—Wings straight. Colour 1.

Leaf.—Dark green and glossy.

Inflorescence.—Inconspicuous. Flowers white and rare. Buds generally drop. Occasionally bolters appear bearing profuse flowers on long stalks.

Tuber.—Round. Skin yellowish-white, rough. Eyes medium, and deep at rose end. Flesh white. Sprouts pink.

Maturity.—Second early to early main crop.

NOTES.—Was introduced to this country several years ago, but has not spread. This is hard to explain in view of the fact that it is an excellent cropper, a good keeper, and very resistant to late blight and virus disease.

FIG. 11. GREAT SCOTT.

ARRAN CHIEF.

Origin.—Raised by D. MacKelvie in 1907, and introduced by him into commerce in 1911. The pollen parent was Sutton's Flour-ball.

Habit.—Medium to strong vigour, tall, upright, and open.

Stem.—Wings very waved. Colour 2.

Leaf.—Medium green. Leaflets small, wrinkled, and V-shaped.

Inflorescence.—Inconspicuous. Flowers scanty, white, with green tips; drop readily in the bud stage.

Tuber.—Round and somewhat flat. Skin white and somewhat rough. Eyes medium depth, clustered towards the upper rose end. The underside carries very few eyes. Flesh white. There is to be observed on the immature tuber a purple coloration at the junction of stem and tuber. Sprouts deep purple.

Maturity.—Late main crop.

NOTES.—An excellent variety for medium to heavy potato-land, and undoubtedly the most valuable commercial white grown in New Zealand. Unfortunately, it is extremely difficult to procure lines free from Northern Star.

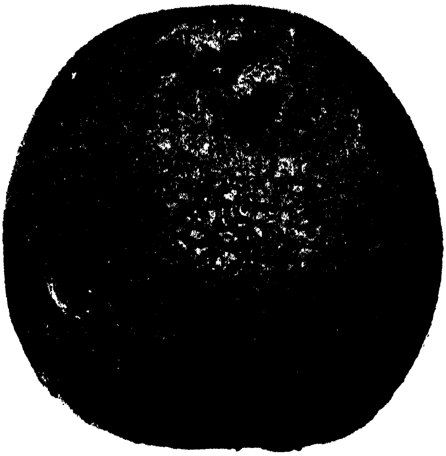


FIG. 12. ARRAN CHIEF.

FIG. 13. NEW ERA.

NEW ERA (PERFECTION, OR PERFECTION NEW ERA).

Origin.—A New Zealand selection which has been tested out in Great Britain and reported to be a bolter from Evergood. The latter was raised by A. Findlay and placed in the market in 1900. It was originally produced under the name of Eldorado. The writer, however, cannot distinguish between New Era and Evergood as described by British authorities, except in the roughness of the skin.

Habit.—Tall, medium vigour, with upright to spreading and open foliage.

Stem.—Wings not waved. Colour o.

Leaves.—Dark gray or yellowish-green. Leaflets crinkled, small, narrow, and pointed and V-shaped.

Inflorescence.—Tall with medium-size trusses. Flowers pale lavender; very rare, and generally fall in the bud stage. Flower-buds green and coloured round base.

Tuber.—Short oval and flat. Skin white. Eyes shallow. Flesh very pale yellow (intermediate). Sprouts very pale pink. Chief characteristic is the presence of a proportion of tubers having a distinctly flaked skin; others are more or less smooth. Both types, somewhat modified, may arise from the same plant. It is probable that maturity and soil conditions affect this characteristic, which is very clear in the illustration.

Maturity.—Early main crop.

NOTES.—Evergood is reported to be of particular value on heavy and peaty soils, and to be highly resistant to late blight. This is true also of New Era, which plays an important part in North Island potato growing.

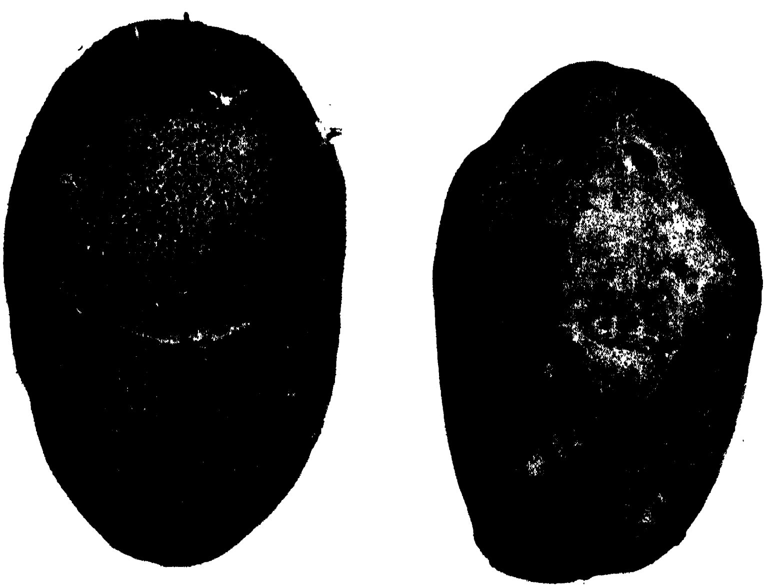


FIG. 14.—FIELD-MARSHAL (LEFT) AND UP-TO-DATE (RIGHT).

UP-TO-DATE AND FIELD-MARSHAL.

Origin.—Introduced to commerce by A. Findlay in 1894 and said to be the result of Patterson Victoria × Blue Don. Field-Marshal is identical with Up-to-Date, except that the tubers have a russet skin.

Habit.—Vigorous, tall, medium, spreading and open foliage.

Stem.—Wings waved. Colour 1. The stems are particularly thick, hard, and woody.

Leaf.—Light to medium green. Leaflets large, and end pair overlap the terminal.

Inflorescence.—Very tall and prominent; borne on thick stalks. Flowers light-red purple, numerous, and lasting over a long period. Colour shades off towards tips of the corolla, but it is not distinctly white-tipped.

Tuber.—Oval to kidney flattened. Skin white and smooth, sometimes roughened. Eyes shallow, mainly at rose end and on upper surface. Flesh white. Sprouts pink.

Maturity.—Early main crop to late main crop.

NOTES.—An excellent variety in every respect, but not grown extensively now owing to the difficulty of obtaining pure lines capable of giving satisfactory yields. This deterioration is almost entirely due to infection by leaf-roll, wilt-disease, and the presence of bolters and wildings. All lines inspected in this country are more or less heavily infected with leaf-roll and wilt-disease. Up-to-Date is frequently grown and sold as Sutton's Supreme. To most people Up-to-Date represents the ideal of what a potato should be. This is evident from the fact that the Scottish Board of Agriculture report no less than 175 synonyms or varieties that are identical with Up-to-Date.

(To be continued.)

PIG-MANAGEMENT.

DEALING with the subject of pigs in his annual report for 1927–28, the Director of the Live-stock Division (Mr. J. Lyons, M.R.C.V.S.), remarks:—

To any one who is familiar with the pig industry of this country it is obvious that if we are to gain a place in the world's market with the products thereof we must materially alter our system as regards the management and feeding of this class of stock. Pigs, if properly fed and sheltered, will thrive excellently in the open during the summer months. Such animals, however, are born in mid-winter or early spring, and it is then that they require most attention if the best is to be got out of them. It is well known that the better an animal is fed and cared for during early life the sooner it will reach maturity, and if through any cause a check is received it may take weeks for the animal to recover, during which period it is being fed at a loss. It is essential, therefore, that every farmer should keep his pigs going well from the time they are dropped. To do this, however, good housing-accommodation (together with a liberal supply of bedding, so that the young animals may be kept warm) must be provided for the farrowing sows, and when reared the young animals must still be housed and given suitable food until such time as weather conditions allow them to be turned into the open. Skim-milk when fed alone is not a balanced ration; too great a bulk of this material is required to bring a pig to maturity. With the addition of concentrates the milk required for one animal could be made to feed two, thus showing a handsome profit for the extra food consumed. When pigs are reared in large numbers in a given space a certain amount of disease is difficult to avoid, but given good conditions for feeding and housing the mortality amongst pigs would be nothing like it is at present. Improved conditions mean increased profits, an object which should be held steadily in view. Pigs should be looked upon as a valuable asset whereby our by-products can be turned into a handsome profit, not as a medium for getting rid of such products.

FEEDING OF CONCENTRATES TO DAIRY COWS.

ECONOMIC DATA FROM LOCAL EXPERIMENTS.

W. M. WEBSTER, B.Sc., M.R.C.V.S., Veterinarian, Live-stock Division.

IN connection with the investigation into the causes of temporary sterility among dairy cows, experimental supplementary feeding with concentrates was undertaken in several badly affected herds in the Wairarapa district during the season of 1927–28. The results in relation to temporary sterility are as yet incomplete, and are outside the scope of this article. However, as the experiments also afforded an opportunity of studying the economic results of such feeding, arrangements were made to collect all available data in this direction.

In considering the material so collected two elementary physiological facts relating to milk-production must be borne in mind:—

(1) Given an adequate ration, a cow is at the flush of her milk-production within three weeks of the time she calves, irrespective of the season of the year.

(2) A dairy cow requires a certain amount of food to maintain her body in its normal condition (without either gain or loss of weight), and from this point of view she ought only to produce milk in direct proportion to the amount of food available over and above her maintenance requirements. However, one of the fundamental laws of nature demands a perpetuation of the species at any cost, and the cow obeys this rule by maintaining her milk-yield as far as lies in her power, no matter how unfavourable the conditions may be. Even though she is obtaining insufficient nourishment she will instinctively continue to produce milk to the best of her ability, at the expense of her own physical condition, for milk is essential to the wellbeing of her calf—that is, the perpetuation of her species. Needless to say, however, the quantity of milk so produced falls considerably short of what she would produce if obtaining an adequate diet.

It is universally recognized in European countries, where supplementary hand feeding is extensively practised and its value during those seasons when there is a shortage of natural pasture fully appreciated, that although a cow will certainly increase her yield at any time during her lactation period in response to generous feeding, she will never give the same gross return if she is stinted at the commencement. A good start at the beginning of the lactation period will give her a lead which she will maintain to the end.

This fact is also appreciated by many progressive farmers in New Zealand, and by those of our stud breeders who have animals under the C.O.R. test, for example. Nevertheless, on the average dairy farm in this country the management of the herd falls far short of this ideal, and all too frequently herds are seen losing condition during the spring months. This is a sure indication that the cows are receiving an inadequate ration and are endeavouring to maintain their milk-yield at the expense of their physical condition. They do not recover that condition or reach the peak of their production until the early summer flush of grass appears, three months rather than three weeks after

calving. Further, their peak production at this late period is never so high as it would have been had they been adequately fed during the early spring and reached their flush at the proper time.

In the experiments here dealt with the three herds selected, which naturally, in the circumstances, contained a high proportion of more or less late calvers, were divided into two equal parts on the basis of the calving-dates, with the object of having an equal number of cows in profit in either group in the herd at any given time. One herd had been tested under the group system in the previous season, and in this instance the two sections were approximately equally balanced on their average butterfat records in addition to their calving-dates.

The two groups in each herd were not separated and were treated alike in every respect, save that, commencing in August, one group in each herd received a daily supplementary ration of 2 lb. of crushed oats and 1 lb. of linseed nuts per head until the time of calving, when the ration was increased by an additional 1 lb. of crushed oats daily. Feeding was carried out once daily in the bails prior to calving, but afterwards the cows received 1½ lb. oats and ½ lb. linseed nuts at each milking. Each animal in the three fed groups received this ration daily until 31st October, when the feeding was discontinued, as there was abundant pasturage available by this date. Two of the herds, including that mentioned above as having been tested during the 1926–27 season, were placed under test in the local herd-testing organizations, while in the third the milk from each group was kept separate and a double account run at the factory throughout the season.

The records thus obtained are extremely interesting and instructive but their significance will perhaps be better appreciated if at this stage a brief description is given of each herd.

Herd A: With one or two exceptions this herd was made up of grade Jerseys. The owner has been testing for several seasons, and two years ago bought in a number of high-grade Taranaki heifers from tested dams. The farm is all fairly good river-flat with a high productive capacity in the early summer, but the district has a low annual rainfall and generally the feed dries up rapidly after Christmas. A small quantity of hay and only a moderate acreage of green crops were available for feeding in the early spring.

Herd B: Crossbred with Jersey predominating, but a considerable strain of Shorthorn blood in evidence. Has been improved by testing and rearing selected calves. The farm consists of drained swamp. The locality has a good average rainfall. The pasturage is good, but inclined to be rank in many parts, and holds well through the summer. A small amount of hay, but a considerable acreage of green oats and cow-grass, was available for supplementary feeding in the early spring and some roots in the autumn

Herd C: A mongrel crossbred herd. Friesian and to a lesser degree Jersey blood predominated, but many animals showed a strain of Hereford, Shorthorn, or Polled Angus blood in their ancestry. The farm is ideal heavy dairying country, with a high well-distributed rainfall. A good supply of hay was available for use in the early spring and a good crop of roots in the autumn.

Table 1 shows the actual production of each group both in butterfat and gross quantity of milk for the season. The average number of days to which these records refer for each group is also indicated. It was stated earlier that each group was selected on the cows' due calving-dates, with a view to equalizing the average period during which the two groups in any one herd would be under test. However, these dates could only be estimated from the service records of the previous season, and on that account some margin of error occurred in herds A and B. Further, on account of the circumstances under which the experiment was inaugurated, the average period is somewhat below the generally accepted nine-months standard. Therefore, in order that direct comparisons may be more easily made, Table 2 has been compiled to show the results from each group reduced to a common basis of 270 days.

Table 1.—Actual Returns.

	Herd A.			Herd B.			Herd C.		
	Average Days in Milk.	Butterfat	Milk.	Average Days in Milk.	Butterfat.	Milk.	Average Days in Milk.	Butterfat.	Milk.
Fed group	249	318·13 lb.	6,429 lb.	236	291·86 lb.	6,734 lb.	245	267·81 lb.	6,996 lb.
Control group ..	236	238·73 lb.	5,526 lb.	251	260·23 lb.	5,964 lb.	245	249·71 lb.	6,151 lb.
Difference	..	79·40 lb.	903 lb.	..	31·63 lb.	770 lb.	..	18·1 lb.	846 lb.
Value of difference ..	..	£5 18s. 6d.	£4 10s.	..	£2 8s.	£3 17s.	..	£1 7s.	£4 4s.

Note: Butterfat calculated at 1s. 6d. per pound; milk at 1s. per gallon.

Table 2.—Returns all calculated for Purposes of Comparison on 270 Days' Basis.

	Herd A.		Herd B.		Herd C.	
	Butterfat.	Milk.	Butterfat.	Milk.	Butterfat.	Milk.
Fed group ..	286·47 lb.	6,969 lb.	308·07 lb.	7,703 lb.	295·11 lb.	7,708 lb.
Control group ..	219·51 lb.	6,321 lb.	272·43 lb.	6,415 lb.	275·13 lb.	6,780 lb.
Difference ..	66·96 lb.	648 lb.	36·64 lb.	1,287 lb.	19·98 lb.	928 lb.
Value of difference	£5 0s. 6d.	£3 4s.	£2 15s. 6d.	£6 9s.	£1 10s.	£4 13s.

NOTE: Butterfat calculated at 1s. 6d. per pound; milk at 1s. per gallon.

Table 3 shows the individual daily production of butterfat for each animal in the two groups in Herd A. The figures for the 1926-27 season are also included as far as they were available, and provide an extremely interesting comparison. The benefit of the feeding in the case of heifers is also clearly shown where the best of the "Control" group is a fraction behind the worst in the "Fed" group.

The cash value of the returns from each group is also shown in Tables 1 and 2. As the net cost of feeding worked out at only £1 12s. 6d. per cow it will be seen that all accounts show a profit except that for butterfat in Herd C.

Table 3.—Herd A, Daily Average of Butterfat for Season.

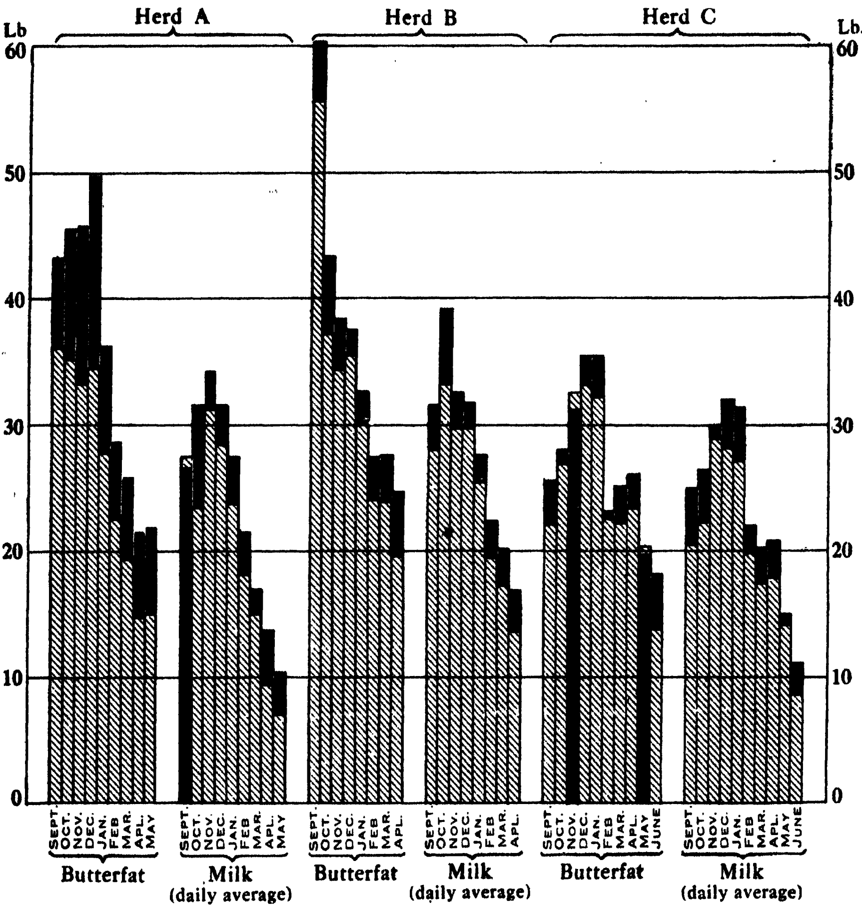
Fed Group.			Control Group.		
No. of Cow.	1927–28.	1926–27.	No. of Cow.	1927–28.	1926–27.
	lb.	lb.		lb.	lb.
1	1·483	0·927	1	1·120	0·962
2	1·406	1·003	2	1·103	0·671
3	1·329	..	3	1·052	..
4	1·316	0·948	4	0·950	1·162
5	1·262	0·937	5	0·922	..
6	1·078	0·856	6	0·863	..
7	0·999	0·893	7	0·762	0·755
8	0·994	0·870	8	0·751*	..
9	0·974*	..	9	0·666*	..
10	0·959*	..	10	0·661*	..
11	0·869	1·205	11	0·646	0·814
12	0·857*	..	12	0·608*	0·986
13	0·840	..	13	0·464*	..
14	0·798*	..			
15	0·757*	..			
Average per day	1·061	0·955	Average per day	0·813	0·892

* Heifers.

The accompanying graph (next page) indicates the average production of each group month by month. The graph also brings out clearly the statement made in the introductory paragraphs — namely, that a cow given a good start at the beginning of the season obtains a lead which she maintains to the end. Although all feeding ceased on 31st October, yet the diagram shows that the "Fed" groups maintained their ascendency to the end of the season.

The variations between the three herds appear very wide, but on consideration the reasons are easily discovered. The rainfall undoubtedly played a part. In the case of Herd C there was a growth of young grass more or less throughout the season, while in Herd A there was little or no growth after Christmas and the summer heat rapidly dried up the grass. The ordinary supplementary feeding carried out in the winter and early spring was also a factor. Herd C received the best treatment in this respect, while Herd A received least. At the same time all three farmers were "doing" their herds somewhat better than the average in the district. In addition, in Herd C there was a higher proportion of late calvers than in the other two, as at least 60 per cent. of each group calved subsequently to 31st October. Thus those late calvers in the "Control" group commenced their milking-period when there was an abundance of natural food available; in other words, they were not stinted at the start.

Apart from these factors, however, the main explanation seems to lie in the type of herd. At the commencement of the experiment the three herds were each in average winter condition. When feeding ceased at the end of October there was no very marked difference in physical condition between the two groups in Herd A. In Herd B the "Fed" group were in decidedly better average condition than the



GRAPH SHOWING YIELDS OF EXPERIMENTAL HERDS.

Whole column shows average production of "fed" group for month; shaded portion shows production of control group; black upper portion indicates difference in favour of "fed" group. "Butterfat" columns represent quantity produced each month; "milk" columns show average daily production.

"Control." The "Fed" group in Herd C came into the yard like a line of fat bullocks fit for the butcher.

Thus the high-testing Jersey strain in Herd A responded to the extra feeding almost entirely in extra butterfat, while the strong admixture of beef blood in Herd C responded equally well in its own way—that is, the benefit of feeding was reflected in bodily fat instead of butterfat. Herd B, as was to be expected considering its apparent ancestry, occupied an intermediate position. Incidentally, this varied response to feeding, and also the fact that the gross milk-yield did not exhibit the same wide degree of variation as the butterfat return, serves

as a good illustration of the soundness of the dairy-farming practice in England, where the dual-purpose Shorthorn preponderates over all other breeds. Conditions, of course, are different and inapplicable to New Zealand: milk production is on a quantity basis only, and fat cattle for slaughter fetch high prices. The dual-purpose animal responds well to heavy concentrate feeding in the increased quantity of milk produced (though it is common knowledge that the quality suffers), but at the same time she puts on condition readily and may be sold fat, if desired, at the end of her lactation period.

Though the results given in this article are strictly accurate as far as they go, they are open to some criticism, particularly in the case of Herds B and C, owing to the absence of antecedent data. Similarly the concentrate ration used may not have been the most economical in respect of cost, and no allowance has been made for the unexpended manurial value of the food consumed. However, as already indicated, a study of farm economics was no part of the original purposes for which these experiments were inaugurated. But despite these qualifications the experiments seem to have shown fairly conclusively that New Zealand farmers should aim at the better feeding of their herds during the early spring months; further, that moderate concentrate feeding during those months only is a payable proposition from a factory viewpoint in a high-testing Jersey herd, and in a case such as Herd A it might conceivably prove more economical than the provision of adequate supplies of hay, ensilage, green crops, or other feed such as could be produced on the farm. On the other hand, the experiments have shown that concentrate feeding under similar conditions should be a payable proposition in any herd which is producing milk on a quantity basis for retail town supply.

It is to be hoped that the results, so far as they go, will furnish food for thought to progressive dairy-farmers, and that they may lead to the inauguration of further trials on similar lines designed solely to test the economic aspect of concentrate feeding.

NEW POULTRY HOUSE AND STORE AT RUAKURA STATE FARM.

FARMERS' FIELD COMPETITIONS.

TARANAKI-WANGANUI DISTRICTS. SEASON 1927-28.

J. W. DEEM, Fields Superintendent, Wanganui.

FARMERS' field competitions were conducted last season in the Taranaki-Wanganui districts on much the same lines as in the preceding year. Entries judged showed an increase of 102, the figures being 370 against 268. The increase was mostly confined to North Taranaki, where Mr. J. M. Smith, Instructor in Agriculture, has been giving this branch of educational work special attention.

Haystack competitions were introduced for the first time, and forty-six stacks were judged. The number of ensilage entries judged showed an increase. The entries in both hay and ensilage were large, but owing to the mild winter a great number of the stacks and pits had not been opened, and therefore could not be judged. This particular type of competition is very popular, and is sure to increase in the future, as the value of good ensilage and well-saved hay is becoming more and more realized.

A falling-off in the number of lucerne stands judged is accounted for by the extremely dry weather experienced during judging-time (January and February), when most farmers who had lucerne growing had to make heavy demands on it in order to keep their stock going. Lucerne in South Taranaki and ensilage in North Taranaki saved the situation on a great many farms during the dry period from January to March.

The actual numbers of entries judged in the various competitions were as follows, last year's figures being shown in parentheses: Mangolds, 97 (90); carrots, 62 (61); swedes, 73 (49); turnips, 9 (9); lucerne, 8 (16); chou moellier, 8 (6); ensilage, 67 (37); hay, 46 (nil).

MANGOLDS.

The long dry spell greatly checked the mangold crop in the early stages, but on the whole this root upheld its reputation as a drought-resister, and when the rain did come it made a wonderful recovery. The ninety-seven crops judged averaged 60 tons 6 cwt. per acre, against 59 tons 13 cwt. in the preceding season and 59 tons 14 cwt. in 1925-26.

The heaviest crop for the season under review was that grown by J. B. Hine, of Toko, which weighed 122 tons 13 cwt. per acre and won the Sutton Cup for North Taranaki. Mr. Hine having won this cup for the third year in succession now wins it outright. The heaviest crop in South Taranaki was grown by H. Betts, sen., and turned the scales at 106 tons 2 cwt. per acre. This crop wins the Sutton Cup for South Taranaki. Mr. Betts also grew the best crop in South Taranaki in 1926-27 (128 tons 19 cwt.) and gained the award for the Sutton Cup, which he afterwards lost on a technical point as to the date of entry. To compensate him for this the donors of the cup, Sutton and Sons, through their New Zealand agents, J. G. Ward and Co., Ltd., presented Mr. Betts with a gold medal. Mr. Betts, who is now in his ninety-second year, has set an example for some of the younger competitors by saying that he is going to win the Sutton Cup outright if he has to

live until he is a hundred to do it! P. Turner, of Brunswick, won the Wanganui Sutton Cup with a fine crop weighing 90 tons 6 cwt. The Prizewinner variety was placed first, second, and third in every competition in the past season.

Rotation: It is generally considered bad practice to grow the same variety of crop in the same ground year after year, onions being a notable exception. At the same time it is recognized that if the cultivation is good and the manure adequate mangolds may be grown on the same area for several years. Mr. Hine's performance affords a splendid example of this. He has grown the champion crop in central Taranaki for four seasons in succession in the same field, the weights being as follows: 1925, 89 tons 7 cwt.; 1926, 111 tons 13 cwt.; 1927, 90 tons 11 cwt.; 1928, 122 tons 13 cwt., per acre. The last crop was the heaviest and soundest, no signs of disease being noticeable at judging-time. The crops were all Prizewinner, and the fertilizers used per acre were as follows: 1926, 8 cwt. super and 10 cwt. salt; 1927, 7 cwt. super and 5 cwt. salt; 1928, 3 cwt. super, 3 cwt. slag, 1 cwt. kainit, and 5 cwt. salt. In addition, the crops had a few loads of cow-yard manure each year. The cultivation was good, and the growing crop was able to utilize the fertilizers applied.

General practices: The weights and varieties of manure, amount of seed, and width of drills were much the same as in the preceding year for the average crop. Most of the best crops were given from 4 cwt. to 6 cwt. of phosphatic manure plus 3 cwt. to 5 cwt. of kainit or salt, per acre. Full details on these aspects were given last year in the *Journal* for October (pages 259 and 260).

CARROTS.

This crop also suffered in the early stages, and, though deep rooting, did not stand the dry weather as well as mangolds, although the crop made a good recovery after the late autumn rains. Most of the roots were badly shaped and only fair quality. The average was 39 tons 17 cwt., against 45 tons 8 cwt. in the preceding season and 44 tons 12 cwt. in 1925-26. Matchless White, Barriball, and Guerande were again the most successful varieties. The heaviest crop, one of 69 tons 15 cwt. (Matchless White), was grown by J. J. Sulzberger, of Duthie Road, Mangatoki. This beats the 1926-27 champion crop by 1 ton 14 cwt. It was certainly a splendid crop, and reflects great credit on Mr. Sulzberger for the care given it.

Guerande carrots again did well, six crops in the Maxwell locality averaging 50 tons 3 cwt. Manures and general practice were much on the same lines as detailed last year. Mr. Sulzberger's crop was grown with a mixture of half super and half bone—5 cwt. to the acre. H. Birch, Maxwelltown, wins the Cooper Cup for the best crop of carrots in the Wanganui district, with a fine crop of Guerande weighing 59 tons 2 cwt. per acre.

SWEDES.

This crop is on the increase, especially in central Taranaki, where some very nice crops were seen. The seventy-three crops judged averaged 38 tons 9 cwt., against 44 tons 5 cwt. in the preceding year and 41 fons 6 cwt. in 1925-26. The heaviest crop this past season was

grown by J. F. L. Vickers, of Midhirst, and weighed 65 tons, against the best crop in 1926–27 of 64 tons 2 cwt. Superlative, Masterpiece, Magnum Bonum, and Grandmaster gave the best results. Many of the crops were suffering more or less from club-root, and a number were ruined by this disease. On the other hand, there was very little dry-rot, only traces being found in most crops. An exception was the Otakeho district, where a few crops were badly affected; this locality was also the worst last year. Manures and general practices with the swede crop were much the same as in the preceding season.

MR. VICKERS'S CHAMPION CROP OF SWEDES FOR NORTH TARANAKI (65 TONS PER ACRE).

SOFT TURNIPS.

There was only one competition in soft turnips. The average of the crops judged worked out at 32 tons 8 cwt. per acre.

CHOU MOELLIER.

On the whole the weather was too dry for chou moellier during the main growing-period, although close up to Mount Egmont there were a few good crops. The eight crops judged averaged 25 tons 19 cwt. per acre. Where not fed off, chou moellier grew most of the winter.

LUCERNE.

As already stated, the dry weather adversely affected the lucerne competitions, as very few of the crops were at the right stage for judging at the prescribed time. Consequently several districts cut out their competitions.

ENSILAGE.

Ensilage-making is now a standard practice on most of the dairy farms in North Taranaki, and on a great many in South Taranaki and farther down the coast. There are indications that it will not be long before most farmers in Taranaki adopt this method of providing autumn and winter fodder, besides solving the difficulty of controlling the surplus grass during the flush period. There are only a few tower silos in Taranaki, but ensilage pits (or trenches) are steadily increasing; however, the majority still depend on the stack. At one time ensilage-making was very strenuous work, but since the mechanical stacker (or hoist) and sweeps have come into more general use the hard work has been largely eliminated, and most farmers who now make ensilage consider it easier than haymaking. In the course of our rounds for judging, some very fine silage was seen, both in pits and stacks. The pit has the great advantage that waste is greatly reduced, but against this in many cases has to be added the extra cost of haulage to the pit, compared with a stack built in the field where the material is grown. A few special crops such as oats and tares are grown, but most farmers depend on surplus grass.

Of the sixty-seven entries judged forty-five were stacks, twenty-one pits, and one a tower silo. The silo owned by H. E. Batten, Tokaora, Hawera, was awarded 97½ points out of a possible of 100, while the best pit, that of A. J. Haseltine, Hawera, received 92 points, and G. H. Bell's, Oakura, 91 points. The best stack was that shown by Honnor Bros., of Hurangi, which gained 87½ points, or 10 behind the silo. The points awarded to these four crops under the different headings are interesting, and particulars are given in the following table. Maximum points are: Quality, 40; colour, 10; evenness, 10; degree of waste, 20; covering, 15; and site, 5—total, 100.

Name.	System.	Quality.	Evenness.	Colour.	Waste.	Cover.	Site.	Total.
H. E. Battle ..	Silo	39	10	9½	19½	15	4½	97½
A. J. Haseltine ..	Pit	38	9	9½	18	13	4½	92
G. H. Bell ..	Pit	38	8	8½	19	13	4½	91
Honnor Bros. ..	Stack	36½	8	8	17	13½	4½	87½
Average ..	21 pits	35·3	8·3	7·8	16·2	12·0	4·3	84·5
Average ..	45 stacks	32·8	7·2	7·3	14·1	12·5	4·4	77·2

Mr. Bell's pit is in a bank. The sides are absolutely perpendicular and are plastered with concrete; the pit has a capacity of 130 tons. Filling started on 12th December, and was continued on the 13th, 16th, 17th, 19th, 21st, and 24th, the material being weighted down with stones on the 25th. Honnor Bros.' stack was a round one, 24 ft. in diameter. Building started during the second week in December; the stack was built up to 6 ft. high, then rested for a day; building then continued for three consecutive days, and the weighting earth was placed in position on the following day.

HAY.

Last season was the first time that hay competitions have been held in Taranaki, and a total of forty-six entries at five centres were judged.

The material was judged in the open stack and points were awarded as follows: Quality, 40; condition, 25; building, 25; and site, 10. This being the first year's experience, the allotment of points was more or less experimental, and although the allocation worked quite well it is probable that some slight adjustments will be made for the next competitions.

The season on the whole was not good for first-quality hay. The clovers were late in coming away, and consequently there was very little of it in many of the stacks. On the other hand, the weather during harvesting was good, and most crops were saved in very fair condition. The average for quality, out of a possible 40, was 30·5; for condition (possible 25), 21·2; and for building (possible 25), 20·3.

The supply of rushes, raupo, and other thatching-material is getting scarce in most localities, and while a few stacks were well thatched there is an increasing tendency to use corrugated iron. If this is carefully done it is very effective, and probably the cheapest in the long-run. Five pounds' worth of iron covers a big stack, and it will last for years.

The best stack was shown by Mr. Hellier, of Lepperton, and consisted of a good mixture of clovers and rye-grass; 37 points out of 40 were awarded for quality, and the total points were 89½ out of 100. Mr. H. Wallace won Mr. W. C. Weston's special prize for the best-built stack, gaining 24½ points out of a possible 25. This stack was a credit to the builder, and it was very pleasing to listen to the complimentary remarks passed by a number of the farmers who accompanied the judges.

GENERAL.

In most districts field competitions are run by branches of the Farmers' Union, Settlers' Association, and kindred bodies, who are responsible for organization, prizes, &c. North Taranaki has gone one better and set up a committee to foster competitions. This committee consists of representatives of the agricultural and pastoral associations, Farmers' Union, settlers' associations, and Department of Agriculture. The main function of this committee is to foster and co-ordinate the competitions and to provide as many championship prizes as possible. Already the committee has received a number of special trophies and donations.

In conclusion I should like to thank the various committees for the arrangements they made to assist the judges; the local newspapers for the keen interest they took in the competitions and the full publicity given to the results; and Instructors Smith, Glasson, and Freeman, of the Fields Division Staff, who assisted with the judging.

Testing Butter for Water Content.—During the official year 1927–28, as in the past, every churning of butter intended for export shipment has been tested for moisture by the Dairy Division. A total of 137,265 churnings were tested, the average water content being 15·10 per cent., as against 15·15 per cent. for the previous year. The churnings over the legal limit of 16 per cent. represented a percentage of 0·73 of the total, and the usual practice of returning these to the dairy companies to be reworked with drier butter was followed.

SEASONAL NOTES.

THE FARM.

GRASS ENSILAGE AND INTENSIVE GRASS-FARMING.

It is inadvisable to greatly increase the number of cows milked on a dairy farm prior to the adoption of an intensive manuring and rotational grazing scheme unless some provision is made for the supplementary feeding of the cows during the late summer and autumn, when grass-growth is usually poor. A big reserve of fodder in the form of grass ensilage allows the stocking of the farm to be greatly increased, and the maximum results obtained from the spring and early summer production of grass, by providing a certain supply of fodder for the late summer and autumn. Storage of some of the surplus production of grass as silage should therefore become just as much a matter of routine on dairy farms as the making of hay. Besides providing a reserve of fodder for supplementary feeding during periods of poor grass-growth, the mowing of rank pastures during November greatly improves the subsequent pasture-growth. Pastures cut for silage in November produce much more feed in the autumn than pastures cut for hay. Grass ensilage made in pits or trenches requires much less manual labour than where the material is stacked in the field. Indeed, it is really much easier to convert the material into ensilage, where the pit method and horse-sweeps are used, than to make it into hay. The sweeps can be used to deliver the freshly cut grass at the trench or pit, and as the pit becomes filled the horses passing over the green material help to consolidate it.

THE DAIRY FARM AS A LABOUR UNIT.

Many people are looking to a very rapid improvement in production on dairy farms from the adoption of schemes of intensive manuring and rotational grazing. There are, however, certain factors that may limit this rapid improvement, and one important factor is the farm as a labour unit. Fifty-acre farms, carrying twenty to twenty-five cows and employing the full time of one man, and 100-acre farms carrying thirty-nine to forty-five cows and employing the full time of a man and a boy, are probably the commonest sizes of farms in most dairying districts. Twenty years ago, before phosphatic top-dressing was widely adopted, and before the milking-machine was perfected, the 50-acre farm carried about fifteen cows, and the 100-acre farm twenty to thirty cows. The adoption of the practice of phosphatic top-dressing has virtually doubled the carrying-capacity of grass-land, and the use of the milking-machine has enabled the same labour units as were required previously for hand milking to now milk double the number of cows. It has taken some twenty years for this change to be accomplished, although it was early demonstrated that the application of phosphatic manures roughly doubled the produce from grassland.

At the present time the butterfat production of farms situated on similar land varies enormously. For instance, on 50-acre farms in

old-established dairying districts the butterfat production varies from 100 lb. to 200 lb. per acre, and the herds vary from twenty to thirty-three cows. High production per acre is nearly always associated with high carrying-capacity. There is considerable room for improvement in production on farms with a low per-acre production by the adoption of better feeding and the building-up of better and larger herds of cows. An increase in the number of cows on these farms would in most cases not require any additional labour for milking. The herds on 50-acre farms that are producing 150 lb. to 200 lb. of butterfat per acre have in most cases reached the maximum size that can be economically milked with the plant and labour available. An increase in the size of the herds on these farms, unless family labour is available for milking, will require the employment of additional labour for milking. It is important, therefore, when considering the increased carrying-capacity that is possible from the use of intensive methods of manuring, that the cost of milking the extra cows should be taken into consideration on farms that have now a high carrying-capacity.

LUCERNE.

Established stands of lucerne are generally ready for the first cutting some time in November. It is unwise to cut too early, as this usually reduces the weight and number of subsequent cuts. Flowering is frequently late in the spring, and the stage to cut is often determined by the appearance of fresh buds at the base of the crown. As the weather is often unsettled in November, the first cut of lucerne on dairy farms is preferably made into ensilage. For this purpose it should be stacked along with grass from early-mown pastures. This is usually advisable, because the quality of the silage is better when lucerne is mixed with grass.

November is usually the best month for sowing new stands, and care should be taken that lucerne is only sown on land that is perfectly dry in the winter-time. The seed-bed should be carefully prepared. The crop frequently does best after grass, but care should be taken that the land is free from twitch. Many promising stands of lucerne have been ruined by too early cutting in the first year. The first cutting should not take place till the young plants are blooming and fresh buds have appeared at the base. Cutting before this stage is reached greatly weakens the vigour of the young plants.

ROOTS AND GREEN FORAGE-CROPS.

The main sowings of soft turnips, Aberdeen turnips, and swedes take place in November and December. No general rule for time of sowing can be laid down, as conditions vary so greatly in different districts. In Canterbury the attacks of the grass-beetle on newly germinated plants is often serious with November sowings. The root-crop competitions, where they have been carried out for a number of years, have given very valuable information as to the best time for sowing in particular localities.

The main sowings of rape, kale, chou moellier, millet, and maize for green fodder should be made in November. Mustard or Italian rye-grass should be sown with rape; the mustard is best sown after

the rape is up in two rough leaves, so that both crops mature together. Japanese millet should not be sown too early; any time after the middle of November in the warmer localities, and the first week in December in colder districts, is quite soon enough.

—*P. W. Smallfield, B.Ag., Fields Superintendent, Auckland.*

THE ORCHARD.

SPRAYING OPERATIONS.

THE blossoming-period will now have almost passed, and in a good many localities apple and pear trees will be ready for the petal-fall sprays recommended in last month's notes. The period is very critical, as black-spot almost invariably makes its appearance at this time of the year. As some time may have elapsed since the last spraying prior to blossoming, and as it is necessary to refrain from applying the sprays while trees are in full bloom, no delay should now occur in affording trees protection after petal-fall. It is quite safe to spray when 75 per cent. of the petals have fallen, as the function of the blossom and the process of pollination will have been completed. Foliage and fruit will be developing rapidly, the unfolding leaves and swelling fruits requiring renewed protection. A second cover spray should be applied to apples and pears seven to ten days after the petal-fall. Later on the intervals between sprayings may be extended to seventeen days.

On most varieties of pears bordeaux has been recommended, and if weather conditions are favourable for black-spot development bordeaux 3-4-50 should be continued. Otherwise lime-sulphur 1-100 or 1-120 may be used on all pear varieties. Arsenate of lead for codlin-moth control must also be applied, and may be used in combination with either bordeaux or lime-sulphur at the rate of 1¾ lb. powder to 100 gallons of spray. Apples require careful consideration now, and the orchardist must decide between the use of lime-sulphur and sulphur in the free form (precipitated sulphur in paste and powder forms, dry-mix, &c.). Lime-sulphur is more efficient as a controllant of black-spot and is a useful insecticide, keeping in check such insect pests as red mite and scales. It is, however, rather severe on certain tender varieties, on trees lacking in vigour, and on the older leaves as the season advances, unless heavily diluted. Free sulphur, although not altogether efficient as far as black-spot control is concerned, is not injurious to foliage, acting more as a tonic; moreover, it is a controllant of powdery mildew.

If lime-sulphur is favoured it should be weakened down as the season progresses, first to 1-120 and later to 1-140. If the orchardist aims at controlling both spot and mildew a combination of the two forms may be used. I would suggest lime-sulphur, 1-120, plus 8 lb. to 10 lb. precipitated sulphur. However, on the tender varieties such as Cox and Dunn's, and on the less vigorous trees, it is advisable to drop the lime-sulphur and continue with precipitated sulphur only. Later in the season, and if weather conditions are not favourable for black-spot, lime-sulphur may be dropped on all varieties. However,

it often happens that red mite is allowed to increase, and more damage is done to foliage by this pest than occurs by the continued use of lime-sulphur. Therefore I would recommend using the weaker-strength lime-sulphur in combination with precipitated sulphur for several sprayings on such varieties as require it.

Arsenate of lead, 1½ lb. to the 100 gallons of spray, should be applied with every regular spraying. The leaf-hopper usually makes its appearance as the leaves unfold, and Black Leaf 40, strength 1–800, should also be added to the spray. It is often necessary to apply this with the petal-fall spray. If not applied then, it is almost certain to be required by the time the second cover-spray is due. However, if a sharp lookout is kept and Black Leaf 40 applied while the hopper is in the nymph stage, little trouble from this pest should occur.

Stone-fruit should receive further sprayings, chiefly for brown-rot. Dry-mix sulphur and lime, or else lime-sulphur, 1–130, plus precipitated sulphur, 6 lb. to the 100 gallons, should be continued up till picking-time. The latter formula will give better control for red mite and scale insects. If the weather is wet and humid, stone-fruit should be sprayed every week.

FIREBLIGHT.

This disease usually manifests itself towards the end of October, following the blossoming of apples and pears, and is evidenced by a sudden wilting of a number of fruit clusters, usually at petal-fall. Leaves at the base of infected fruit-spurs turn black in the case of pears and light brown in the case of apples. A little later tender shoots may become infected and wilt. Any such symptoms or suspicious signs should be immediately reported to the district Orchard Instructor to investigate, especially in districts where fireblight has not been known to exist previously. By extreme vigilance at this period any fresh outbreak may be located at its inception and traced to its source, thereby making possible its extinction before becoming so widespread that its complete suppression is impossible.

THINNING.

Thinning is one of the most important factors in successful fruit-production, and its importance cannot be too strongly emphasized. The weight of fruit harvested from a well-thinned tree is often greater than that from a tree left to mature the whole of its crop, as the remaining fruits are larger. Here is the cure for the undersized fruit, expensive to pick, expensive to handle, and of low market value.

Uniformity in size may be secured by careful thinning, and diseased and blemished fruits may be removed in the process. The resultant crop is of very much more value, less costly to handle, and of improved quality. Apart from the improvement in the fruit, the advantages to the tree are numerous. The maturing of a well-thinned and distributed crop is less exhausting to the tree; this is evidenced by the better foliage and growth. It is the only way to secure regularity in bearing and maintenance of vigour. The extent to which one should thin can be gauged only by experience. One never comes across instances where thinning has been overdone. On the other hand, it is the experience of many to find that the degree of thinning was totally inadequate. It is a wise plan to disregard the

thinnings on the ground and look only at what fruit is left on the tree; otherwise one is inclined to become alarmed at the apparent waste and lose courage. Thinning should begin early and be pushed on to secure the full advantage from the operation. In most cases by the end of October, when danger of late frosts is usually over, thinning should be tackled in earnest, beginning with Wright's Early, Evans's Early, and Burbank plums, then other stone-fruit, followed by pears and apples. By this time the natural dropping will be over, and the perfect fruits are set. Stone-fruit should be so spaced as to ensure that no two fruits are touching when mature. This is an important point in brown-rot control. Apples often require thinning out to single fruits, especially on older trees and on varieties with short stems, such as Gravenstein.

DISBUDDING, GRAFTS, ETC.

Newly planted trees will require some attention. A limited number of well-spaced shoots should be selected to form the main limbs of the tree, and other shoots rubbed out. Scions on newly grafted trees will be swelling, and the ties will require cutting, otherwise injury may be caused by the tying material cutting in. Scions are often broken off by wind, and it is a wise plan to tie the new shoots to stakes attached to the stock. A fair amount of the growth arising from the stump and branches of trees headed back for grafting should be retained, so as to encourage root activity. Some of these shoots, if in suitable positions, may be used later for further budding or grafting if any grafts fail to take.

CULTIVATION, ETC.

The maintenance of good tilth to retain soil-moisture is most important. Many of our fruit-growing areas suffer long periods of dry weather during the summer, and loss of soil-moisture early in the season results in poor foliage and small fruit. Therefore every effort should be made to secure a fine earth mulch early. An occasional stirring of the soil, particularly after rain, to prevent the forming of a crust, will then keep the land in good condition.

FROST-PREVENTION.

Orchardists who have made some provision to ward off frosts by means of orchard heating should not be tempted to re-store pots before the end of November. Up till that period weather conditions should be watched closely.

—*N. J. Adamson, Orchard Instructor, Hastings.*

Citrus-culture.

Cultivation: Growers should endeavour to secure good cultivation as early as possible, ploughing and cross-ploughing where this has not been done. Dig up all strips of land and the area near the trunk of the trees, and from then onward maintain a clean cultivation for a depth of from 4 in. to 5 in. by the use of the hoe under the trees and horse implements on the open land.

Manuring: Oranges and lemons will greatly benefit at the flowering season by an application of nitrate of soda, 1 lb. to 2 lb. per tree, according to its size.

Spraying: Oranges—At this season young scales are on the move, and it is wise to spray with oil, 1–40, after the fruit has set; this spray will also account for thrip, which were troublesome on oranges during the past dry season. Lemons—Where bordeaux, 4-4-40, has not been applied to the setting crop this should be done, and repeated two weeks later to ensure cover of later-developed fruit; oil, 1–40, can with advantage be applied immediately after bordeaux for scales and thrip.

Reworking: It is timely to work over, by budding, trees which have a good root-system but are otherwise unsatisfactory as regards type or cropping. —*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

LATE-HATCHED CHICKS.

THE end of October brings to a close the correct season for hatching out chicks of any breed. It is a recognized fact that the late-hatched bird never gives a high annual egg-yield, nor does it produce an egg of desired size for the export trade. Not only this, it is usually more susceptible to disease and parasitic infection than the early-hatched bird. Of course, where the majority of the hens in the flock are old, and the hatching of young stock has been delayed owing to inability to secure broody hens, poultry-keepers may certainly be advised to hatch out some chicks to replace the old and unprofitable birds, even if they are brought out on the late side.

But, while it is a mistake in the ordinary course to have late-hatched chickens on the plant, it is a greater mistake to hold on to old hens that have passed their profitable period of production. Where the hatching-period is to be extended, the young birds, as pointed out in last month's notes, must receive the best possible attention if they are to make satisfactory development. This involves clean fresh ground, shelter, good nourishing food, and, above all, a plentiful supply of green material. The adoption of incubators and brooders, or the securing of day-old chicks, is the only safe means of having the full complement of chicks brought out at the right season of the year.

THE GROWING STOCK.

With the advent of summer it is important that special care be given to the young stock. Every effort should be made to provide conditions as ideal as possible, in order to guard the birds against a set-back during the trying hot months. After drafting chicks from the brooder to the colony-house special care should be taken to prevent them huddling in corners by night. The colony-house should be rounded off with 1 in. mesh wire netting; then in the event of the chicks piling up they have an opportunity of securing fresh air. It is a mistake to try and harden the chicks off too rapidly after leaving the brooder. Obviously, to remove the young birds from a cosy secluded quarter to an ordinary colony-house is only encouraging them to huddle in their endeavour to secure the warmth and seclusion

they have been accustomed to. While the hardening-off process should be carried out by degrees, the chickens should at the same time be encouraged to perch as soon as possible. It is all against the birds making sound development to allow them to huddle together when hot-weather conditions prevail.

It is commonly believed, and rightly so, that early perching will cause crooked breast-bones. This trouble, however, will be reduced to a minimum if wide perches are provided. A board about 4 in. wide will serve for the purpose. Do not allow the chickens to sleep on a hard floor, as probably this is the most common cause of crooked breast-bones.

The floor should be well bedded down with perfectly dry straw. Grass hay should never be used for this purpose, as it is apt to heat and bring on a sweated condition of the chickens, with serious results. The chief trouble caused in this way is an inflammation of the veins. It first makes it appearance in the hock-joints, which become discoloured. Then a gangrenous swelling follows. In a few days the wings become affected in a similar manner, and later the neck and head swell. At this stage death is usually near at hand. There is no cure for this trouble; it is only a question of prevention. Do not overcrowd, provide ample ventilation, keep the floors clean and dry, and check everything that tends to create a moist atmosphere.

EGG-SHELL QUALITY.

At this period of the year, when the great majority of the birds are laying to their full capacity, weak-shelled or shell-less eggs are apt to be produced. These not only mean a direct loss, but they also encourage the birds to acquire the habit of egg-eating. Such eggs are easily broken, and once the hens have tasted the substance it will probably not be long before they learn to break the shells of the normal eggs for themselves.

Weak-shelled or shell-less eggs are usually caused through the bird's inability to secure the necessary lime as a shell-forming material. Losses through thin-shelled eggs, &c., can be considerably reduced by keeping the birds well supplied with fresh crushed oyster or other sea-shell, while broken burnt bone is also valuable for this purpose. Bleached shell, such as is often collected from the sea-shore, is not so good, as it does not contain the necessary lime to produce the desired strength of egg-shell. It is a mistake to provide the shell—or, indeed, any kind of grit—in a narrow receptacle. The best plan is to place it in a shallow box at least 1 ft. square. In this way the birds are given an opportunity of scratching it about and securing pieces they like best.

The lack of lime is not always the cause of weak or soft-shelled eggs. The overfeeding of rich food, such as meat and meat-meal, are often responsible. Thus, where a liberal supply of egg-shell-forming material is available to the birds, and eggs with poor-quality shells are produced, it will be found a wise course to reduce the amount of forcing diet. Of course, even on the best-managed plants an odd bird may lay imperfectly shelled eggs owing to an overfat condition preventing the reproductive organs from functioning in a normal way. Obviously, such birds should not be retained on the plant.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

SWARMING AND HOW TO DEAL WITH IT.

UNTIL a beekeeper has passed through his first season it is well to depend upon natural swarming for any increase required. After a season's experience a more reliable method may be adopted for enlarging his operations. If increase by natural swarming is followed it is well to effect delay so far as the first swarms of the season are concerned. Very early swarms are not advisable, as the weather and flow of nectar are not always to be relied upon. Usually the swarms are smaller than when delayed, and may have to be fed should the weather prove unfavourable after they have been hived. On the other hand, when swarming has been delayed for two to three weeks the weather and flow of nectar are certain to be much more favourable. In any case, the swarms will be larger, and the work of the parent hive and the swarm will go on rapidly and without interruption.

One of the chief factors in delaying swarming is to enlarge the hive. By giving the colony a super more working-room is provided, the nurse bees are kept busy, and the queen has additional combs in which to lay. Of course, there is a right and wrong time for doing this. The best time to add additional supers is when the brood-chamber is getting fairly full of bees, the weather mild, with a fair flow of nectar, and before queen-cells are started If the supers are placed on the hives before there is a good force of bees and plenty of emerging brood, there is a danger of the extra space causing a check on brood-rearing, as the additional space will affect the temperature of the hive. However, if the supers are not put on before queen-cells are started it will be too late to have the desired effect, and the preparations for swarming will proceed.

When putting on the supers, if the weather is mild, a frame containing a little sealed brood should be transferred from the brood-chamber to the centre of the upper box, and also two of the side frames of comb, all with adhering bees, placing the latter combs one on each side of that containing brood, and filling their places below with drawn-out combs or frames of foundation.

The presence of several queen-cells in a hive points almost invariably to the fact that swarming is about to take place. When a number of queen-cells are sealed the swarm emerges headed by the old queen, accompanied by the majority of the field-bees. The swarm will seek an alighting-place usually some distance from the hive, and cluster there like a huge bunch of grapes, while skirmishers from the cluster will go further afield seeking a permanent home. However, the beekeeper usually intervenes and provides the permanent home before the swarm has decided on one. The swarm is gathered into a box, which is placed in the shade, and towards sunset is transferred to a clean hive in its permanent position. Next day work starts with vigour, and, given favourable weather, within a week honey and pollen and worker-eggs will be appearing in the combs. The presence of worker-eggs is an indication that the colony is queen-right.

In the parent hive the young queen will be developing, and the first one to hatch will, unless prevented by the workers, crawl over

the combs and endeavour to tear down any other queen-cells she may find and to sting to death their occupants. If foiled in this she will probably lead another swarm from the hive. This may occur three or four times in one hive, leaving the parent stock badly reduced in numbers and the beekeeper with several small swarms which will be useless to provide a surplus. The remedy for this state of affairs is for the beekeeper to examine the hive immediately after the first swarm has emerged, and himself destroy or remove all the queen-cells but one or two.

Unless there is a good honey-flow, or if bad weather sets in, the swarms should be fed inside the hive. This is to give them a good start, and to provide them with material for producing wax. Excellent combs can be produced from sugar-syrup. Feed only the best white cane-sugar. It is advisable in all cases to hive the swarm on full sheets of foundation, and thus take advantage of the natural instinct of the bees to produce wax after swarming. Very little time will be gained if the bees are put on to drawn-out combs.

Frequent examinations of the colonies—every week or ten days during the swarming season—for the purpose of cutting out queen-cells will help to check swarming, but this requires considerable work, and, since it frequently fails in spite of every care, is not usually relied on.

The occurrence of swarming is largely due to overcrowded brood-chambers. This condition of affairs irritates the nurse-bees, which start rearing queen-cells. Therefore, give the queen plenty of room to lay. A suitable plan is to remove all the frames of brood, except the two centre combs, from the bottom chamber. Empty combs or frames fitted with sheets of foundation are put in their place. Secure the queen, and confine her in the new brood-chamber below a queen-excluder, placing the old brood-nest directly above, thus giving additional work for the nurse-bees and plenty of room for the queen to lay. In six to eight days examine the top frames, and remove any queen-cells that may have been built. If for some reason this plan is not desirable, swarming may be controlled and the strength of the colonies equalized by transferring part of the brood from the strong to the weaker ones. Empty worker combs or frames fitted with sheets of foundation are used to replace the transferred brood-combs.

The age of the queen is another factor in promoting swarming. Just as the poultryman relies on his pullets for greater egg-production, so the beekeeper should rely on young queens, and the sooner he realizes this the less trouble he will have in keeping swarming down to a minimum. It is the exception for a queen of the current season's rearing to swarm. Ventilation also plays an important part in controlling the natural inclination to swarm, and care should be taken to provide sufficient at all times of the season. No single system will be found universally effective. Climatic conditions frequently play an important part in bee behaviour. It will be found, however, that the methods stated, or a variation of the same employed either singly or in combination, will materially assist in the prevention of swarming.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOMATO CROP.

On the main tomato crop under glass the lower bunches will now be ripening, and the plants will be well up the strings on which they are trained. This mass of foliage and the increasing sun-heat make it necessary to give careful consideration to ventilation if the plants are to be kept healthy and hardy and a suitable dry atmosphere is to be maintained. This attention is specially necessary in the early morning of fine hot days. About the time of the first picking—which usually takes place towards the end of November—it is customary to trim off and carry out the lower leaves that shade the ripening bunch, and on well-drained soils that are likely to become overdry a straw mulch of stable litter is now applied. The forcing manures that have been carefully avoided previously may, now that a number of fruit branches have set, be applied from time to time in a liquid form to help the swelling bunches.

Planting the outside tomato crop is done in most districts at about this period. A good bordeaux spray is often suitable treatment for the young plants before they are removed from the boxes. It not only prevents fungous disease, but is a considerable deterrent to insect pests by making the growth unpalatable. Carefully scrutinize each plant before putting it out, discarding those that are blind or untrue to type, soft, or stunted. The early paying crops can be obtained only by setting out good plants at the proper stage of growth. Plant them firmly and rather deep.

VEGETABLES AND POTATOES.

Late broccoli, savoys, and kale should now be sown for winter supplies, or in the warmer districts the autumn and hardier cauliflowers in the place of broccoli, as they have the advantage of a much earlier maturity. Make these beds on good, moist land, and sow them thinly. In no class of vegetable-seeds is there such a wide range of quality as in those mentioned. Needless to say, the best results can only be obtained by using first-class seed-strains. Asparagus-beds must not be allowed to become dry at this season. An ounce of nitrate of soda to each 4 gallons of water is an excellent stimulant now for this crop. Carefully inspect the early potato crop when in flower, and mark down sufficient of the best plants for seed tubers.

STRAWBERRIES AND OTHER SMALL-FRUITS.

The strawberry crop will be ready for the pickers during the coming month, and arrangements for its distribution should be made now. This popular fruit requires expert handling to ensure it being delivered to the consumer while the berries have all their freshness and aroma. To do this the fruit must be gathered in the cool of the day when the plants are free of moisture. The stage of ripeness must depend on the distance they have to travel, but at the beginning of the season, when the weather is cool, they should be riper than later in the season, when they will ripen quicker in transit. If the pickers are properly instructed and supervised very little rehandling should be necessary. The berries should be picked with a short stem and placed in the punnets; these

must be filled, and the top is required to be a fair sample of the fruit beneath. This is a legal requirement, and shipments packed in any other way are liable to bring trouble on the seller. Overripe, misshapen, and undersized berries should be picked and placed in a separate container and sold for culinary purposes. Keep all punnets and crates clean, as this will add very much to the appearance and value of the pack. The berries at all times must be kept in a shaded cool place that is free from dust. Gritty and rain-splashed berries are of no value, so the mulch of straw or rushes should be laid in good time to avoid that danger.

Culinary gooseberries will also soon be ready for gathering. They should be marketed promptly, before the early stone-fruit commences to come on the market. Culinary fruit is in short supply at this season, and gooseberries are useful in supplying it during this interval.

Raspberry and loganberry plantings now require light cultivation in fine weather to destroy weeds and conserve moisture. Apply nitrogenous fertilizers as necessary to induce satisfactory growth, and remove unnecessary sucker growths in the alleys.

TOBACCO-CULTURE.

The earlier plantings of tobacco will now be established in the field. There should be very few gaps in the rows if the plants were well selected and carefully placed. Any replacements should be made promptly with specially selected plants, as otherwise such replacements are backward and cause more work than they are worth. Hoeing, and cultivation may now be done with horse-drawn implements, and, if regularly attended to, the plants will benefit, and very little hand cultivation and hoeing will be required later, when the danger of damaging the leaf makes cultivation with horses impracticable. The sooner planting is completed the better.

Precautions should be taken to guard against cutworm attacks. The following is a good poison-bait recipe: Take 1 lb. Paris green, 3 lb. treacle, and 1 bushel bran; boil the Paris green in 1 gallon water; pour the treacle into the boiling mixture and stir well, then take off fire; add the bran to the treacle and Paris green mixture, and work it up quickly by hand, preventing the mixture from forming lumps. Arsenate of lead, 2 lb., may be used instead of Paris green.

This material should be broadcast at the rate of 1 bushel per acre. One application is usually sufficient. Rain spoils the poison, and when rain falls before the poison has had an opportunity of being effective it should be resown. The poisoned bran should be sown with the assistance of the wind; the bran being thrown in the air, the wind will scatter it more or less evenly over the surface of the ground. The first night probably as many as 75 per cent. of the caterpillars will be poisoned.

—*W. C. Hyde, Horticulturist, Wellington.*

Registration of Plant Nurseries.—A total of 695 nurseries were registered by the Horticulture Division during the last financial year, this being an increase of 58 registrations compared with the preceding period.

WEATHER RECORDS: SEPTEMBER, 1928.

Dominion Meteorological Office.

GENERAL NOTES.

DURING September the rainfall for the month exceeded the normal in nearly all parts of the North Island, except at a few places in the Gisborne and Napier districts and at Russell. In the South Island it was below normal in the eastern districts, but all the western half of the Island and the Nelson and Marlborough Provinces had an excess. The fall was more than double the average in places with a westerly aspect in the North Island and also in south-west Otago.

On account of the prevalence of strong westerly winds the temperature range was not large, and the mean was usually about the average or slightly below. There were, however, occasions when rather severe frosts occurred in the inland and eastern districts. On the 23rd, for instance, a short-lived cold snap caused damage to apricots in Central Otago.

In most parts of the Dominion the month was a stormy one on account of the numerous depressions of the westerly type which were in evidence. September, which is the first spring month, is one during which the westerly is the normal type of pressure system; but this year they have been not only unusually frequent, but also of much more than ordinary intensity. The only northern cyclone which affected New Zealand was the one which appeared to the north-west of the Dominion on the 3rd. By the morning of the 4th its centre had reached Cape Maria van Diemen, and during the night of the 4th it crossed the Auckland Peninsula. Rain fell over most of the North Island on the 4th and 5th, and the falls were heavy at places in the northern and east coast districts. On the 6th a secondary developed in the northern portion of the cyclone, which had by then moved to the south-east of New Zealand. But the secondary soon became merged in a very intense depression which advanced over the Tasman, and which covered the New Zealand area on the 7th. During the 7th and 8th stormy conditions with strong north to west winds to gales were experienced, and heavy rain fell in most districts. The gale was particularly severe in Hawke's Bay, where considerable damage was done, especially to power lines. By the 9th winds had backed to south-westerly, still with gale force at many places, but except in the western and southern districts conditions were improving, and by the 10th mainly fair to fine weather prevailed, while a weak anticyclone was crossing the Dominion.

After this date and until the 28th low-pressure disturbances of the westerly type prevailed, and they were frequently of a very intense character. As a result, winds were generally strong northerlies or westerlies, and gales were of almost daily occurrence in many parts of the Dominion. A small tornado passed over the northern portion of Hokitika on the 18th. The most notable of the low-pressure disturbances was the very intense and extensive one which was experienced between the 22nd and 28th. With it were associated very low-pressure readings on the 23rd and 24th, especially in the southern portion of the South Island. At Akaroa, at 9 a.m. on the 24th, the barometer registered 28·62 in. The northerly and westerly gales which were associated with this disturbance were exceptionally severe in many parts of the Dominion, and at places, particularly in the Poverty Bay and East Cape districts, on the 21st to 22nd, caused considerable damage to buildings, trees, &c.

The 25th was a very stormy day, many parts of the North Island particularly experiencing a fierce northerly gale with heavy rain, severe thunderstorms, and hail. Auckland, Waihi, Rotorua, Te Kuiti, and Patea suffered severely. A number of buildings were wrecked by a tornado at St. Helier's Bay, Auckland. During the 25th pressure rose, but on the 26th a further wave crossed the southern portion of the Dominion. After its passage winds changed to south-westerlies, which were general by the morning of the 27th. By the 28th an anticyclone had advanced across the Tasman Sea, and from then until the close of the month the weather was more generally fine over the Dominion than at any other period during September.

A notable feature of the month was the frequency of thunderstorms and hail-showers, nearly all parts of the Dominion having been subject to them to a greater or less extent. Snow also fell on several occasions, chiefly on the high

country of the South Island, but some of the lower levels had slight falls with the strong south-west winds on the 26th and 27th.

Although conditions generally were of an unsettled, squally character, there were brief intervals of fine weather, and sunny days were not infrequent in districts with an easterly aspect.

—*Edward Kidson, Director of Meteorological Services.*

RAINFALL FOR SEPTEMBER, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	5·26	14	0·90	4·75
2	Russell	4·13	14	0·65	4·36
3	Whangarei	6·82	20	1·97	4·91
4	Auckland	7·84	23	1·47	3·65
5	Hamilton	8·34	22	1·98	4·40
6	Kawhia	9·52	23	1·80	4·32
7	New Plymouth	9·06	26	2·28	5·22
8	Riversdale, Inglewood ..	16·47	23	3·06	9·48
9	Whangamomona	14·52	21	2·41	7·15
10	Eltham	9·55	21	1·26	3·91
11	Tairua	9·90	19	2·04	4·78
12	Tauranga	7·84	20	1·62	4·41
13	Maraehako Station, Opotiki	7·00	20	1·30	4·18
14	Gisborne	1·87	10	0·68	3·01
15	Taupo	9·22	19	1·85	3·82
16	Napier	2·39	12	0·79	2·19
17	Maraekakaho Stn., Hastings	2·39	20	0·67	2·58
18	Taihape	5·93	23	0·70	3·44
19	Masterton	3·61	18	0·68	3·13
20	Patea	5·75	21	1·02	3·58
21	Wanganui	3·11	13	0·60	2·96
22	Foxton	3·32	13	1·20	2·43
23	Wellington (Karori Reservoir)	3·54	15	0·64	3·50
	South Island.				
24	Westport	10·30	25	1·73	6·82
25	Greymouth	11·92	24	1·63	7·96
26	Hokitika	14·18	26	2·11	9·33
27	Ross	18·24	21	3·00	13·06
28	Arthur's Pass	22·96	16	3·81	15·50
29	Okuru, Westland	12·86	19	1·55	12·48
30	Collingwood	15·94	20	2·46	10·13
31	Nelson	5·51	16	1·37	3·75
32	Spring Creek, Blenheim ..	4·34	13	0·98	2·69
33	Tophouse	11·44	21	1·83	5·47
34	Hanmer Springs	5·19	12	1·04	4·10
35	Highfield, Waiau	1·82	9	0·56	3·12
36	Gore Bay	0·96	7	0·25	3·31
37	Christchurch	0·93	10	0·37	1·79
38	Timaru	0·36	7	0·12	2·07
39	Lambrook Station, Fairlie ..	0·68	7	0·26	2·21
40	Benmore Station, Clearburn	2·06	14	0·56	2·10
41	Oamaru	0·29	7	0·07	1·69
42	Queenstown	5·55	13	1·21	2·47
43	Clyde	0·63	5	0·22	1·06
44	Dunedin	1·93	15	0·37	2·74
45	Wendon	2·06	14	0·42	2·32
46	Gore	4·32	17	1·01	2·65
47	Invercargill	5·34	21	0·64	3·11
48	Puysegur Point	11·12	25	1·32	5·53
49	Half-moon Bay	7·46	24	0·75	4·54

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1928.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams (entered in flock-books)	1,046	1,255	3,218	846	3,527	2,259	12,151
Other rams	34,255	96,639	79,565	18,456	79,684	75,601	384,200
Wethers	336,489	587,432	636,741	221,254	549,165	693,566	3,024,647
Breeding-ewes	1,339,246	3,680,579	3,192,053	727,800	3,337,802	3,256,571	15,534,051
Dry ewes	56,056	253,339	160,701	43,203	197,017	158,811	869,127
Lambs	613,383	1,919,935	1,490,173	349,484	1,372,402	1,564,257	7,309,634
Totals, 1928	2,380,475	6,539,179	5,562,451	1,361,043	5,539,597	5,751,065	27,133,810
Totals, 1927	2,289,488	6,317,884	5,350,448	1,369,648	5,102,411	5,219,137	25,649,016

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1919–28.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	11,415,159	1,814,391	6,208,284	23,919,970
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,989,180	1,336,306	5,724,053	23,285,031
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,073	23,081,439
1924	332,814	179,533	9,727	132,137	654,211	2,807,832	12,896,561	1,036,723	6,381,249	23,775,776
1925	355,579	184,744	7,867	131,485	679,675	3,063,663	13,530,479	875,899	6,398,239	24,547,955
1926	370,535	192,055	10,053	138,526	711,169	3,212,435	13,756,197	1,069,682	6,155,510	24,904,993
1927	388,274	199,219	8,644	144,897	741,034	3,074,974	14,632,511	823,047	6,377,450	25,649,016
1928	396,351	205,720	7,347	145,969	755,387	3,024,647	15,328,331	861,780	7,163,653	27,133,810

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1928).

Breed.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in flock-books)—									
Merino	..	1	..	1	9,408	13,043	6,719	29,170	29,171
Lincoln	482	2,098	5,642	8,222	521	97	429	1,047	9,269
Romney	16,082	14,446	79,887	110,415	9,094	4,746	37,418	51,258	161,673
Border Leicester	701	..	316	1,017	455	10,269	12,416	23,140	24,157
English Leicester	800	24	96	920	1,008	18,686	612	20,306	21,226
Shropshire	407	..	72	479	58	2,405	1,511	3,974	4,453
Southdown	4,332	9,481	29,620	43,433	1,007	16,660	2,219	19,886	63,319
Corriedale	264	62	2,131	2,457	1,053	35,308	12,269	48,630	51,087
Ryeland	629	282	669	1,580	1,065	1,968	139	3,172	4,752
Other breeds	102	..	..	102	109	1,094	775	1,978	2,080
Totals	23,799	26,394	118,433	168,626	23,778	104,276	74,507	202,561	371,187
Sheep of distinctive breed but not entered in flock-books—									
Merino	9,443	26,896	6,273	42,612	194,924	512,938	328,945	1,036,807	1,079,419
Lincoln	13,395	49,346	15,499	78,240	2,467	10,797	4,682	17,946	96,186
Romney	390,146	1,472,780	1,137,985	3,000,911	121,522	115,760	275,618	512,900	3,513,811
Border Leicester	3,133	2,187	747	6,067	2,660	31,500	34,727	68,887	74,954
English Leicester	2,470	2,446	1,043	5,959	8,199	61,034	8,087	77,320	83,279
Shropshire	2,662	223	925	3,810	1,691	6,105	2,990	10,786	14,596
Southdown	10,678	23,504	47,328	81,510	1,587	21,904	1,596	25,087	106,597
Corriedale	1,755	843	29,347	31,945	26,580	595,671	387,284	1,009,535	1,041,480
Half-bred	5,530	1,097	13,894	20,521	230,313	750,539	331,443	1,318,295	1,338,816
Ryeland	406	11,754	250	12,410	88	1,369	202	1,659	14,069
Other breeds	264	138	263	665	23	2,182	248	2,453	3,118
Totals	439,882	1,591,214	1,253,554	3,284,650	596,054	2,109,799	1,375,822	4,081,675	7,366,325
Crossbreds and others not otherwise enumerated	1,916,794	4,921,571	4,190,464	11,028,829	741,211	3,325,522	4,300,736	8,367,469	19,396,298
Grand totals	2,380,475	6,539,179	5,562,451	14,482,105	1,361,043	5,539,597	5,751,065	12,651,705	27,133,810

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CONTROL OF SHEEP LEG-LICE.

"FARMER," Mangapehi :—

I should be glad of information regarding the life-history of leg lice on sheep. At what time will dipping be most effective?

The Live-stock Division :—

The female of the sheep leg-louse (*Haematopinus pedalis*) lays about one hundred eggs, each egg being attached to the hair by its small end. There is no metamorphosis, and the young louse appears from the egg after about fourteen days. It then passes through several moults, and the females become mature and ready to lay eggs in from thirty to thirty-three days from its first appearance as an egg itself. In view of this life-history it will be clear that the best means to adopt for control is to dip once and repeat the dip in sixteen to eighteen days' time. It is necessary for the sheep to be totally immersed, because the louse is frequently on the face as well as the legs. If only a few sheep are affected they can be treated by applying the solution to the legs and face.

SPRAY FOR KILLING GORSE.

"GORSE," Glentunnel :—

Can you advise a mixture for spraying gorse that will kill the root without being injurious to the soil or to stock grazing where the spray is used?

The Fields Division :—

It is difficult to recommend anything that will fully comply with these requirements. We have found a solution of salt and water very effective with gorse, but the soil will generally not grow anything for about two years after the application. The procedure is to add salt to water until a potato will float in the solution. The material should then be applied with a large sprayer. Two applications have generally been found necessary. The treatment is not injurious to animals.

FEEDING IODINE TO FARM ANIMALS.

G. A. BICKNELL, Greytown :—

Would you be so kind as to give me particulars of iodine salts for feeding to animals, and the amount to be used; also where the material can be obtained.

The Live-stock Division :—

Iodine is given to animals in very small amounts, the most common method being to mix this mineral with others in the form of a salt lick. Potassium iodide is the form in which iodine is usually administered, about 2 oz. to 4 oz. being added to 100 lb. of the mineral mixtures. The following lick containing iodine in correct proportion is recommended for cattle and sheep: Bone-flour, 50 lb; ground limestone, 23 lb.; salt, 20 lb.; sulphur, 5 lb.; oxide of iron, 2 lb.; potassium iodide, 4 oz. The lick may be placed in boxes or troughs within easy reach. As the mixture contains too high a percentage of salt for pigs, in their case the salt should be reduced to 10 lb., the limestone being increased in proportion. If it is intended to feed potassium iodide to sows alone, the following is recommended: Dissolve 1 oz. of potassium iodide in 1 gallon of water, and mix in the feed one tablespoonful of this solution once a day for each brood sow. Any firm supplying licks for stock would add the required mineral on request. Potassium iodide may be obtained from any chemist.

SUDAN GRASS.

A. W., Inglewood :—

Will you please advise me if the Inglewood district is suitable for the growing of Sudan grass, and if it has been tried in New Zealand.

The Fields Division :—

Sudan grass has been well tested all over New Zealand. In very warm situations it does well, but Inglewood would be on the cold side, and you would get better results from Japanese millet. If you do try Sudan grass it would be best to have it in a well-sheltered warm situation.

DAIRY-FARMING INQUIRIES.

MILN BROS., Awamarino :—

(1) Would you please give us a list of ingredients for ointment for healing badly cracked and scabby cow-teats. (2) In case of a cow suffering from palsy of hindquarters, when using oil of turps as a lotion for massaging loins and legs should it be used straight or broken down with another ingredient ? (3) Is there any cure for ragwort poisoning in the early stages ?

The Live-stock Division :—

(1) An ointment recommended for application to sore teats is made as follows : Thoroughly mix together boric acid, 1 oz. ; zinc oxide, 1 oz. ; vaseline, 1 lb. (2) When used as a liniment for frequent rubbing into cow's skin, turpentine should be mixed with three times its own volume of linseed-oil, olive-oil, or other bland substance. (3) Owing to the fact that ragwort acts on the liver in an insidious and slow way, the symptoms of poisoning are not often exhibited until structural alterations have taken place which are not amenable to any treatment by medicinal measures. The only thing to do is to take the animals off ragwort-infested pasture as soon as the very first symptoms occur, if detected.

TREATMENT OF HEIFERS FOR RINGWORM.

ARCHIE BECROFT, Te Hana :—

Last season I had two heifers which grew warty-looking growths round their eyes. It seemed to start with the hair coming out, leaving a rough dry skin which gradually came up to hard growths, some 1 in. long and ½ in. thick. This spring I have some yearling heifers showing the same symptoms—patches of hair off and the skin roughing up, mostly on the top side of the eyes. Any advice will be appreciated.

The Live-stock Division :—

From your description the heifers are probably affected with ringworm. You are advised to wash the affected parts with a solution of soap and washing-soda, and clean up and scrape off the scabs, when dry applying tincture of iodine over the whole patch. If you have no tincture of iodine use kerosene, and repeat the treatment in a week.

MANURING OF TURNIPS.

FRANK M. ROBINSON, Springfield :—

In the Gore experimental plots last season 1 cwt. super plus 1 cwt. Nauru phosphate was used as the standard turnip-manure. (See *Journal* for August, page 123.) Is this mixture recommended for general use in a moderately moist climate in preference to, say, 1½ cwt. super ?

The Fields Division :—

The mixture was used because it had been found that 2 cwt. superphosphate applied with the seed lowered the germination considerably, as mentioned in the report referred to. In our opinion, 2 cwt. superphosphate per acre will give

excellent results if the germination difficulty is overcome. In experiments in Canterbury it was found that when super was mixed with equal quantities of carbonate of lime (ground limestone) prior to sowing the germination difficulty was largely overcome, and results were in every way satisfactory. In your district one would expect to get better results from 2 cwt. per acre of super, plus carbonate of lime, than from an application of super and Nauru phosphate.

IMPORTATION OF ANIMAL-MANURES.

THE annual report of the Live-stock Division for 1927–28 makes the following reference to this subject:—

It is now nearly twenty-five years since the importation of animal-manures into New Zealand was prohibited from all countries, with the exception of Australia and India, which were the chief sources of supply. In those countries the Department of Agriculture inaugurated a system of licensing and inspection of the sterilization of animal-manures intended for shipment to New Zealand, with a view of preventing the introduction of diseases such as blackleg and anthrax through the medium of such manures. This system has stood up to the present, but for some years past the demand for animal-manures from abroad has decreased to the vanishing-point, with the result that the inspection has been carried on at a loss. In consequence of this position it has been arranged to withdraw the inspection from Australia, while the position in regard to Calcutta, where the cost is also considerable, requires to be given consideration in the same direction.

AGRICULTURAL SHOWS, SEASON 1928–29.

THE following show-dates have been notified by agricultural and pastoral associations:—

Poverty Bay A. and P. Association: Gisborne, 23rd and 24th October.
Wairarapa P. and A. Society: Carterton, 24th and 25th October.
Timaru A. and P. Association: Timaru, 24th and 25th October.
Marlborough A. and P. Association: Blenheim, 24th and 25th October.
Thames Valley A., P., and H. Association: Te Aroha, 27th and 28th November.
Manawatu A. and P. Association and Royal Agricultural Society of New Zealand: **Royal Show,** Palmerston North, 30th, 31st October, and 1st November.
Ashburton A. and P. Association: Ashburton, 1st November.
Northern A. and P. Association: Rangiora, 2nd November.
Wanganui A. and P. Association: Wanganui, 7th and 8th November.
Canterbury A. and P. Association: Christchurch, 8th and 9th November.
Egmont A. and P. Association: Hawera, 14th and 15th November.
Otago A. and P. Society: Dunedin, 21st and 22nd November.
Stratford A. and P. Association: Stratford, 21st and 22nd November.
Nelson A. and P. Association: Richmond, 23rd and 24th November.
Auckland Metropolitan A. and P. Association: Auckland, 23rd and 24th November.
Helensville A. and P. Association: Helensville, 29th January, 1929.
Feilding A. and P. Association: Feilding, 5th and 6th February.
Tauranga A. and P. Association: Tauranga, 5th and 6th February.
Dannevirke A. and P. Association: Dannevirke, 12th and 13th February.
Masterton A. and P. Association: Solway, 19th and 20th February.
Whakatane A. and P. Association: Whakatane, 20th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 6th and 7th March.
Methven A. and P. Association: Methven, 27th March.
Te Awamutu A., P., and H. Association: Te Awamutu, 20th March.

Export of Rabbit-skins.—The number of rabbit-skins exported for the twelve months ended December, 1927, was 12,928,669, valued at £682,658, as against 20,444,390, valued at £740,975, for the preceding year.

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RURAL ECONOMICS.

AN ANALYSIS OF DAIRY-FARMING IN AUCKLAND AND TARANAKI.

E. J. FAWCETT, M.A. (Cambridge), Farm Economist, Fields Division.

BROADLY speaking, rural economics may be divided into two sections: (1) The economics of farm management; (2) the economics connected with the disposal of primary products. So far as the New Zealand Department of Agriculture is concerned, it is directing the whole of its attention to the side of farm management. It is held in certain quarters that problems connected with the disposal of produce are of even greater importance than production, and undoubtedly marketing, transport, co-operative measures, and finance are most essential features. Their study and control, however, may be best left to those bodies at present organized to deal with them.

The analysis of management factors can be of very great help to farmers, both those at present on the land and those who are aiming to become landholders. The systematic collection and analysis of facts relative to a large number of farms provides a fund of information which no one farmer has the opportunity of studying in any other way, and the information becomes of great value as a guide in land-purchase and general farm management. But the value of the deductions that may be made depends on the accuracy of the information collected, and the collection of information depends entirely on the co-operation of farmers. Up to the present time we have been met with entire good will, and the foundation has been laid for extended sound work in the future. The method adopted at present is to visit the farms of the selected groups at the end of the season, and collect data relative to the past year. It is found that most farmers are able to give a fairly accurate record of the season's working, and any small faults are statistically "flattened out" when a large number of farms are considered.

THE DAIRY-FARMING INVESTIGATION.

An analysis of the production and costs of some two hundred dairy-farms in South Auckland and Taranaki has recently been completed, and a detailed report is in hand for publication. The following notes provide a brief review of the information obtained.

Although the farms are somewhat scattered they are all situated in good dairying districts. Some are not fully developed, and the variation in returns from them is affected by this condition to a certain extent.

The first object of the investigation was to decide what is the most important feature in dairying. The figures demonstrate that it is production per acre. Much stress is laid on the importance of increasing production per cow, and rightly so, but it should always be remembered that it is possible to keep a few high-producing animals on a farm by understocking. Interest, rates, and general maintenance have to be paid on the whole of the farm, and unless each acre is producing its fair share the expenses connected with it have to be met from the rest of the farm. Therefore the first thing is to aim at high production per acre.

The question which then arises is, What methods should be adopted to get high per-acre yields? The analysis shows that the factor of most importance is to stock the farm to capacity. This necessitates proper pasture-management and preservation of food for winter feeding. Of next importance in production is the factor of herd-average. The number of cases in which high herd-averages result in high per-acre production is not so great as where high carrying-capacity is associated with high per-acre production. It is possible to procure a high average of butterfat per acre from comparatively low-producing cows, provided the land is stocked to capacity. We therefore come directly back to the fact that the proper feeding of the herd is of greater moment than breeding high producers. Too often have farmers sold the poor cows in their herd, expecting to produce a greater total of butterfat from fewer cows. This is quite sound if the farm is overstocked, but when there is sufficient feed for all the animals, it is unsound to cull unless the discarded animal can be replaced by a higher producer. This point has probably been too often missed.

Small farms on the average show a higher per-acre production than do large farms, and especially is it noticeable that high herd-averages are associated with small areas. A high carrying-capacity of heavy-producing cows should be aimed at, and, as might be expected, these two features are generally associated. Where, further, they are associated with farms of an economic area, a high per-acre production on an economic basis is secured. It would appear that the two management factors most directly connected with these ideal conditions are heavy top-dressing and an adequate supply of labour. It is very obvious from the data analysed that heavy-producing farms are heavy-manuring farms, and as production drops manure used for top-dressing drops proportionately. It will be asked, Is this heavy manuring an economic proposition? From the information which is here reviewed the answer is undoubtedly in the affirmative. As previously mentioned, high-production farms carry a greater number of cows per 100 acres, so that when manuring is considered from the cow viewpoint the amount is less per animal even though heavy per acre. When interpreted in terms of manure used per pound of butterfat produced, it is found that the heavy-manuring farms use considerably less than do low-

production farms. In other words, heavy top-dressing gives low manure cost per pound of butterfat, and light top-dressing gives high cost.

So far as labour is concerned, it is used in two ways—firstly, for operations in the milking-shed; secondly, for other farm work, mainly directed toward food-production and general maintenance work. The importance of expert milkers is undisputed, as also is the attitude of the milker towards the herd. In this connection, family labour should be better than hired help as a general rule. The question of labour is bound up with size of farm and size of herd. Generally speaking, it is a fact that high production is found on farms where the greatest amount of labour is available. As production per acre drops, so does the number of people employed on any given area. The number of cows milked per person employed is practically the same throughout—namely, about 16½ cows per person. On the high-producing farms of medium size the amount of butterfat produced per person is higher, despite the fact that there are more people employed. The greatest density of labour is found on small areas, but production per person is low.

The expenses of maintaining a dairy-farm are comparatively simple in nature. It is supposed by many people that herd-replacement constitutes a regular item of expense, but this is not always so. The average number of young animals drafted into our herds every year has in the past amounted to about 21 per cent., but this figure has included increase in total dairy cows, which has averaged 6·8 per cent., and the actual replacement is approximately 15 per cent. Where a farmer maintains his herd from his own heifers the cattle account should show a small profit, as young stock are gaining in value all the time. It is on farms where springing heifers or cows in milk are bought to replace culls that replacement becomes an appreciable expense. This applies perhaps especially on small farms, where as big a milking herd as possible is kept, in order to earn the required income. Maintenance expenses over all the farms surveyed average about £5 per cow, and this can be accepted as a sound general figure. The main item is for manures, but, as before mentioned, high expenditure on fertilizers is justified.

The next single item of importance is for local bodies' rates, which may become a serious matter if not watched. At the present time, however, it would appear that the services rendered warrant their cost. The average rates on these farms represent the interest on £3 4s. per acre. Put in another way, it may be suggested that the services given by local bodies has increased the value of the land by £3 4s., either as an earning unit or through an increase in comfort for which the occupier is willing to pay.

THE SMALL FARM UNIT.

As an indication of the possibilities of dairying on a comparatively small area of land, the position of some fifty farms of an average area of 57 acres may be given. These farms are all of high-production capacity, averaging 125 lb. of butterfat per acre. At 1s. 4d. per pound the gross takings per farm averaged £534 from 25·5 cows, including some £56 derived from pigs and cattle.

The expenses amounted to £138 10s. per farm, or approximately £5 10s. per cow. Wages allowed amounted to £178 10s. or £7 per cow, leaving a balance of £217 for interest. If £217 is capitalized at 7 per cent., we find that it represents £3,100. The value of stock and plant averaged £605, leaving £2,495 as the value of the land and improvements, equal to £43 per acre. As the average amount of mortgage held per farm was £1,500, the farmer's own capital amounts to £1,600. Thus the total income of the family from the farm is £178 10s. as wages and £112 as interest, or £290 10s. altogether. Therefore, if land producing 125 lb. of butterfat per acre can be bought at £43 the position is sound, provided the proportion of capital represented by mortgage is not too high, and assuming that the family is content with £178 10s. as wages. If they are not content with this amount, they must either produce more butterfat per acre or pay less for the land in the first place.

CONCLUSION.

In conclusion, it may be advanced that dairying is the most intensive type of farming possible for New Zealand under our present economic conditions. It is capable of employing intensive labour when the combination of area and productivity is correct. There are two methods which may be adopted to ensure maximum labour utilization—namely, the employment of labour by owners of large areas suitable for dairying, or by gradual adjustment in the size of farms till the economic family unit is obtained for different classes of soil. The latter method allows of maximum density of rural population, which suggests that it should be the national aim in all land-settlement schemes where conditions permit.

AGRICULTURAL LEGISLATION OF 1928.

F. S. POPE, Assistant Director-General of Agriculture, Wellington.

THE legislation enacted during the parliamentary session of 1928, and directly affecting matters coming within the scope of the Department of Agriculture, consisted of the Rabbit Nuisance Act, 1928; the Noxious Weeds Act, 1928; the Orchard and Garden Diseases Act, 1928; the Canterbury College and the Canterbury Agricultural College Amendment Act, 1928; and the Reserves and other Lands Disposal Act, 1928, (section 12).

The following matter gives the main points to be noted in connection with these Acts, but any one likely to be specially affected should obtain a copy of the particular Act which concerns him from the Government Printer, Wellington, who will supply it on request at a small charge.

RABBIT NUISANCE ACT, 1928.

This Act consolidates, and in some respects alters and adds to, the law in regard to the rabbit nuisance. It repeals the Rabbit Nuisance Act, 1908; the amending Acts of 1918, 1920, and 1921; section 35 of the Finance Act, 1923; section 65 of the Finance Act, 1924; and

section 44 of the Finance Act, 1926. It comes into force on 1st January, 1929, on which date the other Acts mentioned cease to operate.

It makes no radical changes in the law as administered by the Department of Agriculture in those parts of the Dominion where Rabbit Boards are not operating, or as administered by the Boards in their districts in regard to destruction of rabbits generally. The comparatively important changes it effects in those connections are as follows :—

> Inspectors are given the same power in respect of unoccupied Native freehold land not held in severalty as they possess on unoccupied Crown land or unoccupied Native customary land—namely, the power to enter upon such land and take measures for the destruction of rabbits thereon. But in the case of Boards' Inspectors the provisions of subparagraph (*a*) in section 89 of the Act should be borne in mind.
>
> The Department, or a Rabbit Board in its own district, when obliged to undertake the rabbiting of a property because of the "owner's" neglect to do so, is authorized to collect and sell the skins, giving the owner credit for three-quarters of the net proceeds when charging him for the cost of the rabbiting.
>
> It is provided that the protection of an animal, or bird, as a natural enemy of the rabbit need not apply throughout the Dominion as hitherto, but may be given in respect of specific districts.
>
> The Minister of Agriculture, as well as a Rabbit Board in its own district, is given power to erect rabbit-proof fences on private or Crown lands and, with swing-gates, across roads.
>
> The keeping of live rabbits in possession is prohibited save with a permit from the Minister of Agriculture, thus enabling rabbits bearing valuable fur, such as Angora and Chinchilla rabbits, to be kept under approved conditions.
>
> The control of the importation of live rabbits is transferred from the Minister of Internal Affairs to the Minister of Agriculture.
>
> Power is given to make regulations regarding the standardization and sale of rabbit-poison.
>
> The unauthorized removal of carcasses or skins of rabbits from land, as well as the unauthorized laying of poison or destruction of rabbits on land, is prohibited.
>
> Persons who, without authority, persist, after warning, in going on Crown lands while rabbiting is in progress are liable to a penalty.

With the above-mentioned exceptions, and some changes of minor importance, the law as affecting persons and lands outside the districts of Rabbit Boards, and as affecting the destruction of rabbits generally, whether within or outside of Boards' districts, remains as hitherto.

The Act, however, makes considerable alterations as regards Rabbit Boards and their districts, in respect of which matters the law, largely owing to changes in the legislation governing local bodies in general,

had become in many respects difficult to interpret and to administer satisfactorily. Further, the gradual approximation which had taken place in the functions of the three types of Boards described below made it desirable to eliminate any unnecessary suggestion of difference between them, when practically the only ground for such differentiation had become a variation in their rating-powers. The following notes will indicate the nature of the more important of these alterations:—

Under the old legislation there were three distinct kinds of Boards, as follows:—

(1) Those hitherto known as Part II Boards: These were formed by the live-stock owners of the district; there was no limit of area; the basis of rating was the number of stock carried; and there was a Government subsidy of £1 for £1 on the rates collected, with a specified maximum rate of subsidy.

(2) Those hitherto known as Part III Boards: These were formed by the general ratepayers of the district; the minimum area was 2,000 acres; the minimum number of ratepayers was ten; the basis of rating was either the rateable value of all rateable property, or its acreage; and there was a Government subsidy of £1 for £1 on the rates collected, with specified maximum rates of subsidy.

(3) Those hitherto known as Part IV Boards: These were formed by the ratepayers; the minimum area was 1,000 acres; the minimum number of ratepayers was three; the basis of rating was the capital value of all rateable property; and there was no Government subsidy.

Nominally, one of the main changes now made is that there will be only one kind of Board in future; but as, with the exception mentioned later, any Board will be able to levy its rates on any of the bases now applying to the three different kinds of Boards, the change is more one of form than of substance. There are, however, these two material differences: (1) Boards may now be formed on any of the several bases of rating, including the acreage basis; and (2) in future those Boards that were formed under Part IV of the old Act will receive a Government subsidy of £1 for £1 if their area is not less than 20,000 acres, whereas hitherto they have not been eligible for such subsidy.

As indicated in the last preceding paragraph, Boards may change their basis of rating from the stock-carrying basis to the rateable-value basis or acreage basis; from the rateable-value basis to the acreage basis; or from the acreage basis to the rateable-value basis, in every case upon a poll of the ratepayers concerned. There is, however, no provision for changing from the rateable-value or acreage basis to the stock-carrying basis, and consequently this class of change cannot be made.

The rate of Government subsidy to the Boards, whether already existing or established in the future, has not been changed, but Boards formed in the future with an area of less than 20,000 acres will receive no subsidy.

Power is given for the amalgamation of Boards, and for making changes in their boundaries, but no provision is made for abolishing Boards. Should this become necessary in any instance, special legislation will be required.

The machinery provisions in regard to rating have been brought into harmony with present-day requirements.

The general election of members of the Boards has been altered to be on the same date as the general election of members of County Councils, which arrangement will be a great convenience to many electors. Provision is made for postal voting to be brought into force by regulations if found desirable.

The raising of loans by Boards formed by stock-owners has been provided for; hitherto only Boards elected by the general ratepayers could raise loans.

The end of the Boards' financial year has been changed from 31st December to 31st March.

Although boroughs and town districts are excluded from Boards' districts, the Boards are given general powers for enforcing the destruction of rabbits within adjacent boroughs and town districts.

Boards are to consist of six members, but where the acreage is less than twenty thousand the number may be as low as three.

Where the rating is on an acreage or rateable-value basis, owners of less than 10 acres are exempt.

At elections of members of Boards, where there are not more than forty electors, persons nominated by a majority of the electors shall be declared elected.

Boards may levy differential rates according to the degree of rabbit-infestation.

Boards receiving subsidy from the Government must not pay any ratepayer for rabbiting his own land.

Boards must administer Part I of the Act (in regard to destruction of rabbits generally) within their own districts, but must not rabbit Crown land, or Native freehold land not held in severalty and of which no person is in actual occupation, without the consent of the Minister of Agriculture; provided that any Board may hand over to the Minister of Agriculture the administration of Part I in its district, whereupon subsidy will cease to be payable to the Board.

Speaking generally, it will be found that, without adding to the burdens of either the taxpayers or the occupiers of land, the new Act will greatly facilitate the control of the rabbit nuisance in the Dominion.

NOXIOUS WEEDS ACT, 1928.

This is merely a compilation of the existing legislation as contained in the Noxious Weeds Act, 1908, and the Noxious Weeds Amendment Acts, 1910, 1921, 1923, and 1927; consequently it makes no real change in the present law. The new Act comes into force, and the other Acts

mentioned cease to operate, on 1st January, 1929. It will be a great convenience to all concerned to have the whole of the law on this subject consolidated into one Act.

Seeing that the expressions "Second-schedule weeds" and "Third-schedule weeds" are in fairly common use, it may be as well to point out that in the new Act the numbers of the several schedules are changed; what was the Second Schedule to the 1908 Act becomes the First Schedule to the 1928 Act, and what was the Third Schedule becomes the Second Schedule. Thus Californian thistle becomes a First-schedule weed, and broom becomes a Second-schedule weed. This, however, does not alter the law in regard to these or other plants. It is only the names of the schedules that are changed.

ORCHARD AND GARDEN DISEASES ACT, 1928.

With the necessary modifications, the above-written notes on the Noxious Weeds Act apply in this case also. The Acts to be superseded are the Orchard and Garden Diseases Act, 1908, and the Orchard and Garden Diseases Amendment Acts, 1914 and 1920. Here also the numbers of the schedules are changed.

CANTERBURY COLLEGE AND CANTERBURY AGRICULTURAL COLLEGE AMENDMENT ACT, 1928.

As far as Canterbury Agricultural College (Lincoln College) is concerned, this Act provides that the Board of Governors may grant renewals of certain leases in circumstances set out in the Act.

It also provides that in connection with elections of members of the Board of Governors the rolls of electors shall be closed for twenty-eight (instead of fourteen) days before the day of the election.

RESERVES AND OTHER LANDS DISPOSAL ACT, 1928 (SECTION 12).

This section sets apart the Weraroa Experimental Farm of the Department of Agriculture, together with the closed road intersecting it, as an endowment for agricultural research, experiment, and instruction, and authorizes the subdivision and leasing of the land and the use of the revenue therefrom for the purposes mentioned. The land is not to be sold, but parts of it may be declared reserves for purposes of the General Government.

CORRECTION.—In the notes on the agricultural legislation of 1927 published in the *Journal* for January last, the words "(unless they are sold)" should be deleted from the paragraph numbered (2) under the heading of "Apiaries Act, 1927," on page 21.

Cases of Poisoning in Animals.—During the official year 1927–28 seventeen specimens of ingesta and organs from animals suspected of having been poisoned were submitted for examination by the Department's Chemical Laboratory. In several instances of mortality in pigs suspicious amounts of sodium chloride (common salt) were found in the stomach-contents. Strychnine was found in one case, powdered nux vomica having apparently been administered in mistake for a harmless drug to the animal (a dog).

ENSILAGE AND PASTURE MANAGEMENT.

THE TRENCH SILO.

G. W. WILD, B.Ag., Instructor in Agriculture, Hamilton.

ALTHOUGH the making of ensilage has long been practised to some extent in New Zealand dairying districts, it is only during the last two or three years that it has become at all general. Roots and hay have always been the staple winter fodder for dairy cows, and roots must remain so wherever a farm is being broken in from the rough. Under such conditions the laying-down of land to crop is usually a preparatory measure to the ultimate establishment of permanent pasture. But with the great improvement in our grasslands of recent years, due mainly to the liberal use of phosphatic manures, dairymen have become less and less favourable to giving over a good pasture to the plough. For several reasons root crops have proved less profitable in the course of time. This is due to many factors—the waning of the natural soil-fertility, the invasion of certain aggressive weeds such as Californian thistle, the prevalence of diseases, and the ban imposed by dairy factories on forage-tainted milk. This last factor means that all root crops have to be carted out to stock and allowed to wilt before being fed to dairy cattle. There are also the vagaries of the climate—wet springs when cropping is delayed, and dry periods sometimes prolonged to such an extent that root crops become practically a failure.

The drought experienced in Auckland Province last season is a case in point. Supplementary forage crops were generally a failure, and growers were "let down" badly. On the other hand, crops other than annuals are finding increasing favour with dairy-farmers. The permanent grass crop is supreme in this respect, and intensive manuring and better control and management of grassland has brought about great improvement in permanent pastures. The grass crop is at least a certainty until the New Year, and up till that time the portion of it that cannot be consumed by the dairy cattle can be conserved as ensilage. The utilization by grazing of all the spring grass is next to impossible, but as hay and ensilage it forms an insurance against periods of uncertain growth. Ensilage is a fodder that is available to dairy stock shortly after the material is harvested. It can also be kept a year or two, or even more, if necessary, and for this reason alone it is the most valuable succulent fodder.

The foregoing remarks, of course, must not be taken as depreciatory of the value of good hay in the diet, nor as advocating the abandonment of hay production or auxiliary cropping under all conditions.

The present article is written mainly to deal with the labour-economy factor as it affects ensilage. The stack-ensilage method, besides being wasteful of material, usually requires a gang of men for its successful handling. Groups of farmers work in excellently together, yet this system has certain disadvantages. With the present methods of stacking the gang is required for four or five days under the best conditions. If for any reason the gang cannot be kept intact for this length of time the operation is often unduly prolonged. This results in the ensilage running to high temperature, and is the cause of the

brown and charred types so often met with in the stack form. Furthermore, the helpers have to be repaid in kind, so that farmers often are engaged in making ensilage and hay for three or four weeks, and even more. Other operations on the farm tend to be curtailed, and the dairy herd does not always receive the attention it should. The stack method also usually involves the erection of derricks, and other equipment which require extra time and labour for their utilization.

For these reasons many farmers have sought a way to harvest their ensilage crop entirely with their own labour, and thus be self-contained. The hillside silo, and the pit and trench forms, offer these advantages. These types are usually to be found on rolling country, where the "depth" can be obtained. There seems no reason why the trench form, with certain modifications, may not be used under practically all conditions. The construction of such a trench can be done by farm labour, whereas there are few farmers in this country who would undertake the erection of a costly concrete tower silo. These concrete silos cost in the region of £2 per ton capacity, and other mechanical devices such as cutters and blowers are also required. The cost is generally prohibitive here, and with these silos the labour problem is again accentuated at filling-time.

The Trench System.

The storage of ensilage in a trench or pit, although perhaps the first method employed by man, is still one of the most practical ways of preserving this fodder. Provided the fundamental principle of air-exclusion is acted upon and air-exclusion can be obtained only by pressure on the material — then the trench method will prove an undoubted success. Although the most wasteful method is the stack form, when ensilage is badly made in a pit or a trench the waste is also high. Through an incomplete understanding of the principle farmers often dig a pit in sloping ground, with the result that the ensilage is exposed on three sides, for under such conditions the material will settle unevenly and "pull" away from the earth walls.

A trench should therefore be dug on level ground (see Fig. 1) which slopes sharply away at one end. This end will form the mouth of the trench, and from it the ensilage will be carted out to the stock. One end only—or, rather, portion of the end—is thus exposed, and this should be made airtight by boarding up with well-braced tonged-and-grooved timber. (An improvement would be a double bulkhead of timber into which earth could be thrown and rammed down.) If not boarded, air penetrates here, and the adjacent material settles unevenly, tending to pull the ensilage away from the side walls. A properly constructed and filled trench silo should result in no more waste than is obtained with an expensive tower silo.

The trench silo is exceedingly popular in America. A New Zealand adaptation which embraces several improvements is practised by Mr. J. Sutherland, of Kihikihi, Waikato, who ensiles 50 to 55 acres of grass by this system each year. By the use of a home-made, horse-drawn sweep Mr. Sutherland is able to obtain constant pressure on the material while building, and the loss at the sides of his trench is practically nil. The sweep shown in Figs. 2 and 3 allows all these desirable features to be employed.

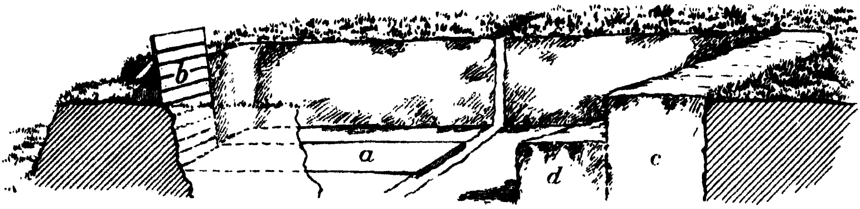

FIG. 1. DIAGRAMMATIC SKETCH OF TRENCH SILO IN BANK.

(*a*) Concrete track into trench ; (*b*) tongued-and-grooved boarding at mouth ; (*c*) first section of material built up at end of trench ; (*d*) second section building.

NOTE.—The diagram represents a side section of the trench, and is broken in middle so that both ends may be shown.

The trench, as its name implies, should be long in proportion to its width. It should also be reasonably deep—at least 7 ft. The sides of the trench should have a batter of 1 in 12 if the land is moderately stiff, and, say, 1 in 8 if the soil is light and crumbly. It is an advantage to have the corners of the trench rounded off to allow better packing there. As the material is usually carted out during the wet winter and spring months, Mr. Sutherland has concreted three-quarters of the way along the bottom of his trench, and also some distance out to give solid access.

For constructing a trench silo a single-furrow hand plough, a scoop, and one or two horses are required. Several trench silos dug in pumice sand last season show no signs of falling in, and from my observations of these I consider that a batter of 1 in 8 is quite suitable for that type of country.

The trench is filled in the following manner. The " crop " is swept to the back of the trench, and either tipped into the trench or on the ground, to be afterwards pushed into the trench by the forkman. Any sort of sweep will do to bring the material to the trench at this stage. The material is filled in in sections—that is, a layer wide enough for two horses with the sweep to walk across is first built up, until it is flush with the ground surface. As soon as this is tramped firm, the horses with the loaded sweep are driven across it. The horses should be led a few times until they become used to the springy nature of the material under their feet. The material is now being tramped thoroughly, and thus forced into the sides of the trench. The sweep will often tip of itself when being driven across the trench ; as the teeth engage in the material and as the horses go forward the whole load will flip over. The horses and the loaded sweep should be driven across this section until it is a few feet above the ground surface, then the extra material pushed over the side to the bottom of the trench again, another layer being thus built up. While this layer is being built up the horses are still driven across the first section. The heart of the material is always kept high, and to this and the thorough treading it receives is due the tight settling to the sides. When the second section is flush with the ground surface, the sweeps should be driven across it and consolidation secured in the same way. This must be continued until the whole trench is filled right to the mouth. The timber at the mouth

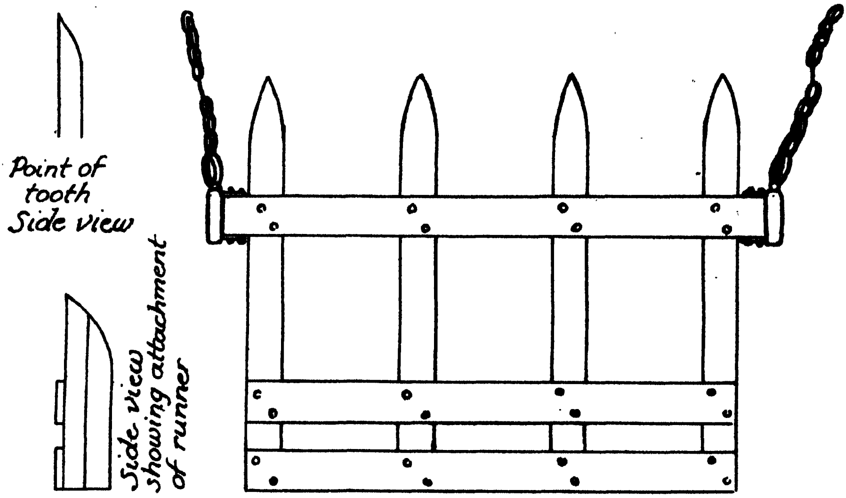

FIG. 2. HOME-MADE SWEEP FOR USE IN TRENCH OR PIT ENSILAGE MAKING.

Dimensions.—Overall width, 8 ft. 6 in.; overall depth, 5 ft. 6 in.; length of tooth from front beam to point, 1 ft. 10 in. *Teeth :* Four hardwoods, 4 in. × 2 in., spaced equidistant. *Front beam :* Hardwood, 6 in. × 2 in., projecting 4 in. on each side to give attachment to 1 in. iron strap. *Foot-planks :* Two or three, ordinary wood, for driver to stand on. *Runners :* Each tooth has a 4 in. × 2 in. hardwood runner attached; this lifts sweep at back and gives point of teeth better penetration. *Chains :* Attached to iron strap on beam by large ring; swivel fixed about 18 in. from ring.

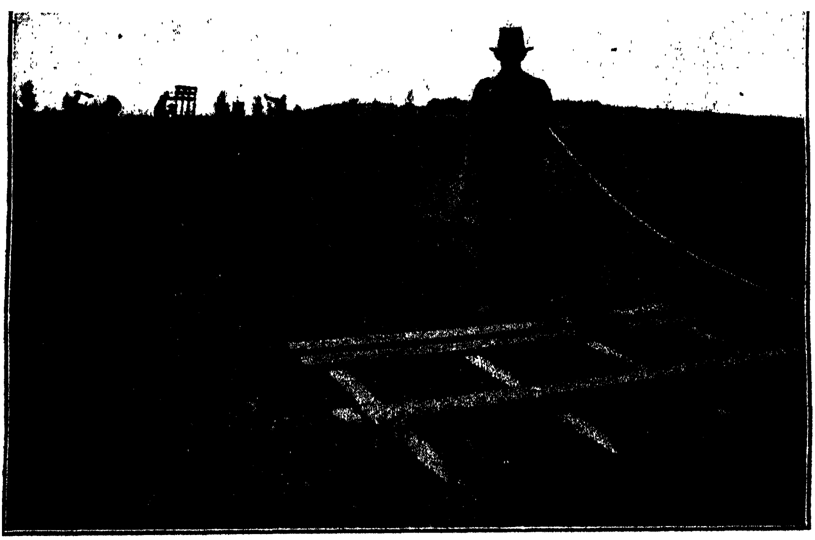

FIG. 3. HOME-MADE SWEEP IN OPERATION.

Mr. Sutherland with sweep in foreground. Sweep in background has gone over trench, and is being righted.

should project a few feet above the level of the ground, so as to give the sweep a guide in to the trench. It is at this spot that consolidation is often underdone and that the material " sumps " badly when settling. If the mouth is not boarded the material will force itself into the mouth or roadway, and in so doing " tie " round the corners. This results in arresting the downward trend of the material, and air-locks and areas of spoilage are formed.

If the trench is built to the right dimensions in relation to the crop two or three days will be taken to fill it—that is, if the crop is to be completely ensiled, the operation takes some four or five days. Each section will settle overnight: therefore each morning more material should be added to bring it up to ground-level again. In fact, it is better to leave the material a few feet above ground-level and high in the centre during the process of building.

As soon as the material is all flush with the ground the horses should be driven lengthwise instead of across the trench. The sweeps can be used to build up a few feet more, but they are inclined to tip at inconvenient moments and deposit half their load where it is not wanted. A sledge is best for topping off, and should have runners 1 ft. high to give clearance. (Some type of sweep that could be driven lengthwise over this material, and which would not tip until necessary would be a decided improvement.) During this operation the sides of the material should be kept straight so that the material will settle into the trench. It may be necessary to use a hay-knife to keep the sides straight. Horses will pull a sledge to a height of 6 ft. to 8 ft. quite easily if a lead-up is given them. This would take the form of extra material thrown down at the end for them to walk up.

When the building is finished this can be cut off square and thrown to the top of the stack now above the ground. At least 18 in. to 24 in. of earth should be put on as soon as the building is completed, as the stack heats quickly at the top. The earth should be well tramped, and be left high in the centre to shed the rain. If the trench has been constructed to the right dimensions the material, when completely settled down, should be within 1 ft. of the top of the trench, either above or below ground-level. More earth should then be used to bank up the sides. The result is then a mound of earth, well tramped and airtight, with no ensilage showing at all. The trench should, of course, be fenced against stock, as cattle, if allowed access, will camp on the earth or horn it up, thus allowing rainwater and air to penetrate to the silage.

CALCULATING SIZE OF ENSILAGE TRENCH.

A heavy crop of grass will return about 3 tons of hay per acre, and this is equivalent to about 9 tons of green grass. As ensilage made under the trench method, this will be about 6 to $6\frac{1}{2}$ tons per acre. The weight of this ensilage per cubic foot averages about 45 lb.

If 1 cubic foot of ensilage weighs 45 lb., a trench 1 ft. long, 8 ft. high, with a mean width of 13 ft., would hold about 2 tons, arrived at as follows:—

$$\frac{8 \times 13 \times 45 \text{ (lb.)}}{2{,}240 \text{ (lb.)}} = 2 \text{ tons approx.}$$

To ascertain the length of a trench of the above-stated dimensions necessary to hold 65 tons of ensilage (the heavy crop of a 10 acre field),

divide the tonnage by the capacity per running foot, and the required information is given. For example, 2 tons = 1 running foot of trench ∴ 65 tons divided by 2 = 32½ ft., the length of trench necessary.

Similarly, in the case of a field of 10 acres producing a good fair crop of 5 tons of ensilage to the acre = 50 tons, the length of trench necessary would be approximately 25 ft.

As regards the mean or average width of trench figured on above, it may be added that the width of these silos at top should be about 14 ft., so as to allow the horses to tread and pack the material when being driven across. Allowing 1 in 8 for batter of walls—which is sufficient—the bottom width of trench would be 12 ft., giving an average width of 13 ft.

THE HOME-MADE SWEEP.

The construction of the home-made sweep used for carrying the cut grass to the ensilage trench is shown in Fig. 2. The sweep requires two horses, and although it will lift the green material from the windrow it is most efficient when the crop has been cocked up. The load can be tipped by lifting the sweep up at the back and urging the horses forward. The sweep is righted by lifting up the outside tooth near the point and urging the horses forward; the sweep then flips back into the working position.

The advantages of this sweep are that it is efficient and speedy; can be made on the farm; can be loaded and unloaded without the labour of forking; and can be driven over the material in the pit, thus consolidating it. Ensilage packed by driving the sweeps over it settles well to the sides of the trench, and there is a minimum of waste. Two men with two horses and a sweep can harvest 2 acres of grass for ensilage in a seven-hour day.

POINTS TO REMEMBER IN MAKING TRENCH ENSILAGE.

(1) Consolidation means air-exclusion and success.

(2) Board up the end of the trench.

(3) Concrete the track out in order to give a solid surface for carts.

(4) Add salt in the making, or, if mineral deficiency is suspected, add a complete "lick," sprinkling it as one would salt.

(5) Wilt the cut material slightly if it is very lush. The amber-coloured liquor which oozes out carries with it the minerals and easily digested constituents.

(6) Stack material each day. Under the method described the temperature tends to run high, and stacking each day controls it.

(7) Keep sides of the "stack" above ground straight, so that in settling the material will readily enter the trench.

(8) Keep temperature below 125° F. if possible. The various types of green ensilage are much superior to the brown.

Referee Seed-samples.—During the past year a series of referee samples was tested by the Agricultural Department's Seed Station on behalf of the International Seed-testing Association, eighty-seven other stations also participating. The results received showed that the work of the New Zealand station compared very favourably with that of the larger European stations.

SLOW DEVELOPMENT OF ACIDITY IN CHEESE-MAKING.

BACILLUS SUBTILIS SHOWN TO BE A FREQUENT CAUSE.

G. F. V. MORGAN, N.D.A., N.D.D., Bacteriologist, Dairy Division, and J. CURLE, Dairy Instructor.

AT the present time the question of slow-working curds in the process of cheesemaking is one of wide interest to the dairy industry, the spasmodic or periodical occurrence of this nuisance being dreaded by dairy companies, factory managers, and workers alike. The chief concern from the companies' point of view is that the slow curd nearly always turns out to be one of very poor quality, having a tendency to inferior flavours instead of ripening normally. For the factory staff the trouble means working for long hours on raw material that experience has taught can only result in a very poor finished product. The problem of slow curds and failing starters has long been present in New Zealand, and some of the possible causes of the trouble have been investigated both in field and laboratory and a considerable amount of data collected.

In a typical case which occurred recently in the Wellington District the points primarily investigated were (1) whether the trouble originated from the milk as received at the factory possibly becoming contaminated at the farm with alkali-producing organisms of a putrefactive type, or of a type that would retard the development of a lactic ferment ; (2) whether the trouble was due to the starter itself or to contamination of the milk for cheesemaking, after pasteurization, by the plants or vats. One point that seemed clear from the outset was that the cause was bacteriological, and not due to a chemical fault in the composition of the milk as was sometimes supposed.

In this outbreak the work of investigation was carried out at a small factory, having only six milk-suppliers, where the trouble had already commenced. Each supply of raw milk was sampled as it arrived at the factory, the samples being taken in thoroughly sterilized bottles. Other samples were then taken from the milk in each vat after it had been pasteurized and cooled and had remained long enough in the vats to be thoroughly mixed by the stirrers. Finally a sample was taken of the starter then in use at the factory, which was showing signs of failing.

The results of the bacteriological analysis of these samples pointed to the fact that certain spore-forming aerobes of the *subtilis mesentericus* group were at the source of the trouble. In view of the fact that both starter and cheese milk were pasteurized, and that organisms of the *Streptococcus lactis* type used as cheese starters are in themselves very virile and not likely to become attenuated or checked by the ordinary alkali-producing bacteria, this supposition seemed most likely to be justified.

The results above mentioned were as follows: The farmers' milk showed a normal bacterial flora, the growth of acid-producing organisms of the *Streptococcus lactis* kind and acid-producing "weeds" appeared

typical of normal cheese milks, and shake cultures in litmus lactose plates showed no sign of a preponderance of alkali-producing organisms. The same, however, was not the case with the samples of milk from the vats. These samples showed a heavy contamination by alkali-producing rods of the *subtilis* type, and on plating out in litmus lactose shake cultures a considerable amount of alkali appeared in the neighbourhood of these colonies, this being an indication of what was going on in the milk. The most surprising results, however, were obtained from the plate culture of the starter, which showed no trace of acidity development, only very occasional pin-point colonies of the *Streptococcus lactis* type, but a very large number of colonies of *subtilis*. (Two days later this starter was dead.)

The results of these experiments showed quite clearly that the fault did not lie with the farmers' milk, but that the milk became contaminated, after pasteurization, by the plant itself. (It has already been shown that *B. subtilis* is practically the only inhabitant of factory plants in parts of the system between the pasteurizer and the coolers.) It was also obvious that a starter which had once become fairly heavily contaminated with spore-formers of this type was unreliable and likely to fail at any time.

After these data had been collected at the factory, further work was carried out at the laboratory (Wallaceville) on the effects of this type of organism in milk, also its power to develop in and finally overcome pure culture starters. It was shown that contamination of active starters by *subtilis* in very small quantities has little effect on their action. However, if *subtilis* once obtained a firm footing it would increase rapidly in numbers, though its full effect might not be felt for four or five days after inoculation, when the starter appears to go quite dead. The results of daily subcultures of contaminated starters in the laboratory were checked by plating out when the subcultures were made, and showed a daily increase of *subtilis* colonies until the time when the starter was so weak that it took two days to coagulate at 70° F. Smears were also made at each stage. In connection with this daily increase in *subtilis* a curious fact was noted. The increase in *subtilis* seemed constant until the starter appeared dead, then suddenly decreased in number very rapidly till it seemed to have almost disappeared, and the *Streptococcus lactis* seemed to revive again and work normally for a time, though isolated rods still appeared. Whether this sudden incidence and almost total disappearance work in regular cycles is still being investigated; factory experience rather points to its probability.

One other point of interest observed in the laboratory was that in contaminated samples that were not subcultured daily there was a very marked increase in the amount of *subtilis* present, as compared with those that were regularly subcultured, also that starters incubated at a high temperature developed *subtilis* much more readily than those incubated at about 60° to 70° F.

During the time the laboratory experiments were being carried out a number of alleged slow milks from factories in various localities were tested. With one exception these milks were contaminated with organisms of the subtilis type to a fairly marked degree.

THE FACTORY EXPERIMENT.

It was then decided to try, under factory conditions, an active starter contaminated with *subtilis*, with an active pure starter as a control.

Organisms of the *B. subtilis* type found in the starters giving slow acid development when used in the cheesemaking were employed in a starter sufficient to work part of a vat of milk. In order to test this starter a vat was filled with pasteurized milk in the ordinary way, and after being well agitated was divided between two vats. One vat had a good normal working starter added ; the other the starter to which had been added the contaminating culture obtained from the laboratory.

The first vat worked normally, acidity developing as looked for in good cheesemaking practice, while the other vat behaved in a manner similar to that obtained when working with what is commonly known as a slow or almost dead starter. At the time of setting, both vats had the same acidity by the alkaline and Marshall tests, and the same acidity in the whey when the curd was cut, while acidity developed to the same extent in each vat during the first two hours after setting. This is usually found to occur with slow starters. Slow starters develop acidity normally up to a certain point (about 0·16 on the alkaline test), and then, as in this case, acid development becomes slow and at times almost stops.

In this experiment the curd in the first vat, containing a good starter, was ready for the salt in six and a half hours from setting, while the curd in the vat with the contaminated starter was ten and a half hours reaching the same stage of maturity. The only difference noticed was that whereas in using the ordinary factory slow starter acid development is slow all the time, in this case there was a rapid development of acidity while the curd was draining, thus tending to show that although the culture used was highly contaminated there was also present a very active lactic acid germ.

The contaminated starter received from the laboratory was subcultured at the factory on the day following its receipt, and tested 0·76 per cent. acidity. On the day it was used it tested 0·70 per cent., while the starter used in the control vat was 0·90 per cent. when used.

The following table gives a comparison between the times and acidities of the cheese made with the contaminated starter, a typical slow starter, and the control vat with a normal active starter :—

Time.	Control Cheese (Active Starter).	Experimental Cheese (Starter and *B. subtilis*).	Ordinary Slow Cheese (Slow Starter).
	Acidity Percentage.	Acidity Percentage.	Acidity Percentage.
Setting	0·19	0·19	0·19
Cutting	0·13	0·13	0·13
1½ hours ..	0·14	0·14	0·14
3 hours	0·18	0·17	0·16
5 hours	0·86	0·27	Commencement of slowness.
6½ hours ..	1·00	..	Considerable variation in times and acidities.
7½ hours ..	..	0·73	
10 hours ..	..	1·00	

Samples taken at various stages from the experimental vat showed that *B. subtilis* was present in considerable numbers in the starter on the day it was used, though *Streptococcus lactic* was also present and apparently healthy. A sample from the vat after pasteurization and the addition of starter showed that *subtilis* was beginning to get ahead. Samples taken at various acidities during the cooking stage showed a steady increase in *subtilis;* and a final sample taken from the "white whey" when cheddaring showed a very great development of *subtilis*, but also showed an increase in virility of the *Streptococcus lactis.*

CONCLUSION.

In conclusion, it may be stated that apart from a considerable amount of *subtilis* appearing in samples of slow milks and slow starters, the conditions found in cheesemaking are suitable for the development and propagation of this organism. In the first place, pasteurized milk is a good medium for its growth; and, in the second place, its spores can remain virile in the pasteurization plant itself, close to the pasteurizer. Experiments have shown that *subtilis* can remain alive and grow beside an active culture of *Streptococcus lactis.* Its biological characteristics show that it is capable of producing marked alkalinity in milk followed by an alkaline peptonization of casein, with the production of ammonia. This accounts for the slow curd developing weak spongy characteristics when maturing.

IMPROVEMENT OF DETERIORATED HILL COUNTRY.

THE annual report of the Fields Division for 1927–28 remarks on this subject as follows :—

The experiments on regrassing secondary-growth country and investigations into the best methods of bringing deteriorated hill country back have been continued, and articles relative to the work have been published in the *Journal.* The past summer and autumn have seen many thousands of acres of secondary growth burnt and sown, and it is pleasing to report general acceptance by the farming community of the hardier grasses and clovers such as brown-top, Danthonia pilosa, and Lotus major, as important ingredients of the seed mixtures sown. This, it is felt, is essentially a step in the right direction. There are still minor differences of opinion as to how much seed of each should be included in the mixture, and many are inclined to adhere to cocksfoot even on the poorer and harder secondary-growth country. It matters little whether cocksfoot is sown or not; the essential thing is to include from 1½ lb. to 2 lb. brown-top, 3 lb. Danthonia pilosa, and ½ lb. Lotus major per acre. Crested dogstail is of outstanding merit for the first three years, and from 3 lb. to 4 lb. should be used; ½ lb. to 1 lb. of white clover, and 6 lb. to 8 lb. of perennial rye-grass provide rapid feed, but these will not last excepting under top-dressing. Other species, such as paspalum, yarrow, kikuyu, and subterranean clover, may also be worth while. Considerable experimental plantings of kikuyu have been made on hill country in Taranaki.

In hill-country work, as compared with that on easy ploughable country where modification of the soil habitat by ploughing, reseeding, manuring, and tripod-harrowing is possible, it is a question of choosing species adapted to the soil conditions as they exist or come to exist after the burning-off of the rubbish. The more the question is studied the more important become those species that can persist and spread under low soil-fertility standards; those that will persist in the shade of secondary growth should this get temporarily out of control; those that will carry a fire and that will recover rapidly once the area has been burned off. Lotus major, paspalum, brown-top, Danthonia pilosa, yarrow, New Zealand rice-grass, and Poa pratensis are outstanding in this respect.

POTATO-CULTURE.

DESCRIPTIONS OF SOME OF THE MORE IMPORTANT VARIETIES.

(Concluded.)

J. W. HADFIELD, H.D.A., Agronomist, Fields Division.

IN the following pages are given a further and final number of descriptions and illustrations of varieties of potatoes most commonly grown in New Zealand, the majority of which are eligible for inspection under the official certification system. Explanatory matter will be found in the introductory article, under the heading of "Scheme of Varietal Descriptions," pages 152–155 of the September *Journal.*

MAJESTIC (FINDLAY'S).

Origin.—Raised by A. Findlay, of Auchtermuchty, Scotland, and introduced into commerce by him in 1911.

Habit.—Tall, open, and vigorous. Commences to spread very early.

Stem.—Wings straight. Colour 1.

Leaf.—Distinctive light ashy green. Leaf and leaflets flat and smooth.

Inflorescence.—Prominent and tall. Flowers creamy white, large, numerous, and persistent.

Tuber.—Kidney, tapering somewhat to heel end (pear-shaped). Eyes shallow. Skin white and smooth. Sprouts faint pink. Flesh white. A freshly dug tuber has a peculiar soapy or cheesy texture on cutting.

Maturity.—Early main crop.

NOTES.—This variety is one of the most popular in Great Britain. Healthy lines are available in New Zealand. Its cropping power is excellent, and the variety should be much more widely grown.

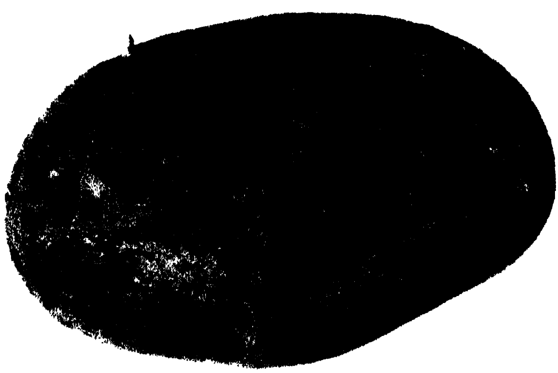

FIG. 15. MAJESTIC (FINDLAY'S).

SHARPE'S EXPRESS.

Origin.—Introduced to commerce by Charles Sharpe, of Sleaford, England. Origin not known.

Habit.—Medium height, spreading, open, and vigorous.

Stem.—Wings waved. Colour 0–1.

Leaf.—Medium green and glossy. Numerous secondary leaflets.

Inflorescence.—Inconspicuous. Flowers red-purple, and rare. Buds drop before opening.

Tuber.—Kidney, tapering to heel end (pear-shaped). Skin white and smooth. Eyes shallow. Flesh white to intermediate. Sprouts pink.

Maturity.—First early to second early.

NOTES.—An excellent variety of fair cropping power, the cultivation of which might profitably be extended.

FIG. 16. SHARPE'S EXPRESS.

SNOWDROP OR WITCH HILL.

Origin.—Produced by John Perkins, of Northampton, prior to 1881, and reselected by Dobbie and Co. as resistant Snowdrop. This variety is of historical interest in view of the fact that it was the first to be definitely observed as immune to wart disease. What are generally referred to as Snowdrop Kidney, Snowdrop, and Witch Hill are identical.

Habit.—Vigorous and of medium height. Spreading dense foliage.

Stem.—Wings waved. Colour 0–1.

Leaf.—Medium green. The leaflets have a characteristically thin and wrinkled appearance.

Inflorescence.—Inconspicuous and rarely standing above top of plant. Flowers creamy white, but rarely formed. Bolters occur bearing erect trusses of flowers.

Tuber.—Kidney (long oval) and flat, often tapering to heel end (pear-shaped). Skin white and smooth. Eyes very shallow. Flesh white. Sprouts pink.

Maturity.—First early to second early.

NOTES.—Excellent quality, but susceptible to late blight. Has been grown in this country for many years.

FIG. 17. SNOWDROP OR WITCH HILL.

BRESEE'S PROLIFIC.

Origin.—Probably similar to the American Bresee's Prolific, a seedling of Garnet Chili raised in 1861 and brought into commerce in 1869.

Habit.—Medium vigour and height. Very open and spreading, almost trailing. The habit is very characteristic, the terminals of the branches tapering off and in appearance much like a tomato plant.

Stem.—Tends to zig-zag and bend at the nodes. Colour 0–1.

Leaf.—Small and medium green. Leaflets widely spaced.

Inflorescence.—Small and short, bearing scanty white flowers.

Tuber.—Oval, flattened to kidney; generally small in size. Skin smooth (except on heavy land) and of a pale straw colour, turning pale flesh colour on exposure to light (most pronounced in young tubers). Eyes shallow, mainly at rose end. Skin round eyes pink, and the eye (generally three buds) picked out in deeper colour. Sprouts pink.

Maturity.—Early main crop.

NOTES.—A good all-round variety, and recognized as the poor man's potato owing to its ability to yield satisfactorily on light land. Large areas of Bresee's Prolific are grown under the names of Magnum Bonum and Early Puritan. Northern Star is a common rogue, although its distinct habit should enable it to be recognized easily.

FIG. 18. BRESEE'S PROLIFIC.

GOLDEN WONDER (LANGWORTHY).

Origin.—The original Maincrop was produced by James Clark, of Christchurch, England, about 1876. Maincrop and Magnum Bonum were raised from the same seed-ball taken from Early Rose. Maincrop was later distributed by J. Niven, Perth, Scotland, about 1905, under the name Langworthy. Golden Wonder was distributed by Brown, of Peashell Farm, Arbroath, in 1906, and resembles Langworthy in every way, except that it has a thick brown russet skin.

Habit.—Tall, vigorous, open, and very upright.

Stem.—Wings straight. Colour 3 in basal portions of stems.

Leaves.—Medium to dark green, and wrinkled (mosaic often present).

Inflorescence.—Tall and prominent. Flowers purple with white tips; numerous, but fall early.

Tuber.—Long, tapering to heel end (pear-shaped). Skin white in Langworthy, and very thick brown russet in Golden Wonder. Eyes shallow, mainly at rose end. Flesh intermediate. Sprouts blue.

Maturity.—Late main crop.

NOTES.—Golden Wonder shows very little promise of extensive culture in this country, mainly owing to its appearance. Langworthy is more popular, especially in the South.

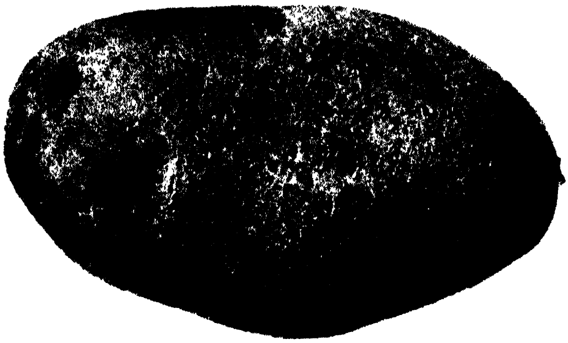

FIG. 19. GOLDEN WONDER.

EPICURE.

Origin.—Raised by J. Clark, from a cross between Magnum Bonum and Early Regent. Introduced into commerce by Sutton and Son in 1897.

Habit.—Upright and open growth, with characteristic flat top. Fairly tall and vigorous for such an early variety.

Stem.—Wings prominent and waved. Colour 2, and somewhat pink.

Leaf.—Dark and very glossy.

Inflorescence.—Short and inconspicuous. Flowers white and rare.

Tuber.—Round and irregular and deeply notched. Eyes deep, with prominent bump above the eye. Eyes well distributed. Skin smooth and white, often blotchy and turning pink on exposure to light. Flesh white. Sprouts pink.

Maturity.—First early.

NOTES.—Probably the most important early variety grown in New Zealand, and has gained this position on its cropping capacity and disease resistance. It

FIG. 20. EPICURE.

is, however, very badly infected with wilt disease and corticium, some lines being very unproductive on this account. When left to maturity the tubers develop internal brown-spot (referred to by graders as " rust "). Bolters occur frequently, and are much later and taller, and flower more profusely.

EARLY REGENT.

Origin.—Not known.

Habit.—Spreading, open foliage of medium height and vigour.

Stem. Wings slightly waved. Colour 0-1.

Leaf.—Light green.

Inflorescence.—Of medium height, producing a few white flowers.

Tuber.—Oval, notched at heel end, distinctly flat on the underside, and rounded on the upper. Skin smooth and creamy white. Eyes shallow and few, mainly produced on upper surface and towards rose end. Sprouts pink. Flesh white.

Maturity.—First early.

NOTES.—A popular and high-quality early. Grown in the South mainly for the seed-trade of the North Island, where the variety is popular for garden culture. This variety is one of the parents of Epicure.

FIG. 21. EARLY REGENT.

KERR'S PINK.

Origin.—Fortyfold x Smith's Early. Raised by James Henry, in Scotland, in 1907. Introduced into commerce by Mr. Kerr, seedsman of Banff, in 1917.

Habit.—Tall, upright, open, and very vigorous.

Stem.—Wings waved. Colour 1–2, extending to midrib of leaf and flower stalk.

Leaf.—Dark green, large, and broad.

Inflorescence.—Very tall and prominent. Flowers very numerous and white.

Tuber.—Round and somewhat flat. Eyes deep. Skin red and rough. Flesh white. Sprouts pink.

Maturity.—Late main crop.

NOTES.—This variety has been in New Zealand for a number of years. It is difficult to say why it has not been grown more extensively, but this is probably on account of the diffidence with which any red potato (apart from Dakota) is accepted. It is a particularly heavy cropper, and of satisfactory keeping and cooking quality.

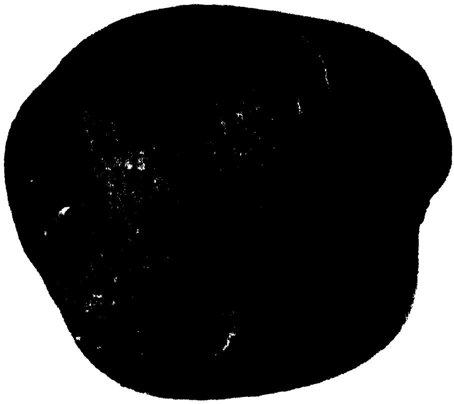

FIG. 22. KERR'S PINK.

ROBIN ADAIR.

Origin.—The writer is indebted to Mr. J. H. Nimmo, of Nimmo and Blair, Ltd., Dunedin, for the information that many years ago this potato was grown by Mr. Shepherd, at Adair, near Timaru, under the name of Cardinal. It was renamed Robin Adair by Mr. Nimmo, and has been grown ever since under that name. Robin Adair tallies fairly well with the description given by British authorities for Cardinal, except that the flower colour is creamy white, whereas it is red-purple in Cardnial.

Habit.—Medium height and vigour. Very spreading and open.

Stem.—Wings waved. Stem colour 2 to 3.

Leaf.—Light green. Leaflets small.

FIG. 23. LEFT—KNOWLER (A SELECTION FROM ROBIN ADAIR); CENTRE—SMOOTH-SKIN ROBIN ADAIR; RIGHT—ROUGH-SKIN OR NETTED ROBIN ADAIR.

Inflorescence.—Tall and prominent. Flowers numerous and creamy white

Tuber.—Kidney to long flattened, often curved. Skin red, sometimes very smooth, other times netted. When netted the tuber is shorter and more blunt at rose end. Both types have been raised from the one selection, and the variation is probably due to environment. Eyes shallow and evenly distributed. Flesh white, often streaked with red. Sprouts pink.

Maturity.—First to second early.

NOTES.—Not grown extensively, but there is a good demand for seed for the North Island trade. *Knowler* is a selection from Robin Adair originating from Southland. It differs from Robin Adair mainly in the skin splashed with colour. The variety was raised by Henry Knowler, and was named by T. D. Lennie, seedsman, now of Christchurch.

KING EDWARD VII (FELLSIDE HERO).

Origin.—Raised by a Northumberland grower who called it Fellside Hero. It eventually came into the hands of Mr. Butler, of Scotter, who named it King Edward VII and placed it on the market in 1902.

Habit.—Tall, erect, moderate vigour, open.

Stem.—Wings waved. Colour 2.

Leaf.—Younger leaflets small and narrow; the last pair tends to enfold the terminal.

Inflorescence.—Inconspicuous. Flowers red-purple tipped with white, but rarely formed. Buds pink.

Tuber.—Oval to kidney, often tapering (pear-shaped). Skin smooth, white, splashed with pink. Eyes shallow. Flesh white. Sprouts pink. The tuber illustrated is not so long as the normal tuber.

Maturity.—Early main crop.

NOTES.—A good cropping variety, but apparently at its best only in certain localities. In England it commands a higher price than other varieties owing to its quality and the fact that it does not darken readily after being once cooked. It has never become popular in this country as a commercial variety, possibly, as merchants have remarked, because it cannot be sold either as a red or a white table potato. Bolters and wildings are common. Red King Edward, Red King, and Rob Roy are selections from King Edward in which the tuber colour is entirely pink.

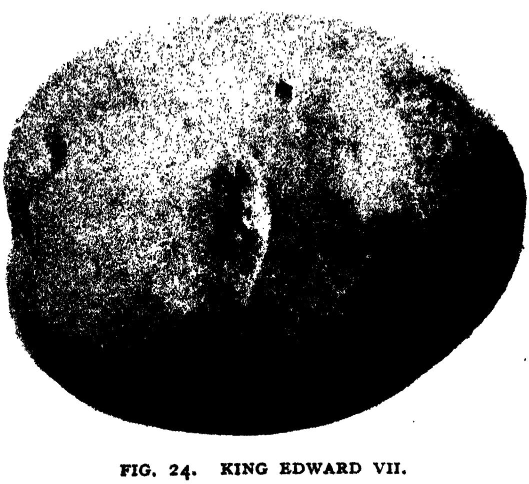

FIG. 24. KING EDWARD VII.

BRITISH QUEEN.

Origin.—Raised by Findlay, and placed in commerce in 1894.

Habit.—Medium height, vigorous, compact, and branching.

Stem.—Wings straight. Colour 2.

Leaf.—Dark leaflet, broad, smooth, and glossy. Secondary leaflets small and numerous.

Inflorescence.—Prominent ; flower-stalks coloured. Flowers numerous and creamy white, the clusters being very large. Buds dark.

Tuber.—Oval to kidney. Skin white and smooth. Eyes shallow, with well developed bump above the eye. Flesh white. Sprouts pink.

Maturity.—Second early.

NOTES.—All lines examined have been mixed, and it is doubtful if pure seed is available. Commonly grown in Great Britain, and seventy-five varieties are recorded as being synonymous.

SUTTON'S ABUNDANCE.

Origin.—Magnum Bonum x Fox's Seedling, raised by J. Clark, and introduced by Sutton and Sons in 1886.

Habit.—Tall, vigorous, upright, compact.

Stem.—Wings waved. Colour 2.

Leaf.—Dark green and glossy. Secondary leaflets numerous and large, giving the leaf a crowded appearance.

Inflorescence.—Very prominent and large, with clusters of white flowers.

Tubers.—Tubers oval to round, somewhat flat. Eyes shallow. Skin white. There is generally a blue-purple coloration at the heel end and on the runners during the growing-season. Flesh clear white. Sprouts blue.

Maturity.—Early main crop.

NOTES.—Still commonly grown in Great Britain, and no doubt in this country also. No pure lines have been inspected. It is reported that ninety-five varieties in Great Britain are synonymous with Abundance.

MAGNUM BONUM.

Origin.—Raised by J. Clark ; supposed to be a seedling of Early Rose. Introduced by Sutton and Sons in 1876. Formerly widely grown in Great Britain, but rarely now.

Habit.—Tall, upright, open, and vigorous.

Stem.—Colour 0–1. Wings slightly waved.

Leaf.—Light green, with red marks at base of leaf and leaflets.

Inflorescence.—Not prominent. Flowers fairly numerous, light-red-purple, tipped with white. Buds reddish purple.

Tuber.—Kidney (long oval). Eyes shallow and mainly at rose end. Skin smooth and white. Flesh white. Sprouts pink

Maturity.—Late main crop.

NOTES.—Bresee's Prolific has been grown for many years under the name of Magnum Bonum. Apparently no pure stocks are available.

SALE OF LICE-INFESTED SHEEP.

IN his annual report for 1927-28 the Director of the Live-stock Division, Mr. J. Lyons, M.R.C.V.S., deals with this matter as follows : " During the past season there has been an increase in the number of sheep exposed for sale affected with lice. This was more particularly in the North Island, and far too many prosecutions had to be taken. No doubt the dry season and the consequent shortage of water was to some extent accountable for this. Still, it would appear that the dipping had been carried out in a more or less perfunctory manner, and was done more to comply with the Act than to rid the flocks of these parasites. If the practice of exposing lousy sheep for sale is to be stopped—and it is my intention to see that this is done—more stringent measures will have to be taken. The ordinary prosecution does not seem sufficient to stop the practice. In future it is intended to stop the sale of all lice-infested sheep, to be followed by a prosecution, and in the case of second or subsequent offences a heavy penalty will be asked for."

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

TARANAKI AND WANGANUI DISTRICT COMPETITIONS, SEASON 1927-28.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

THE season of 1927-28 saw a general all-round improvement in the work and an increase in the entries of the boys' and girls' agricultural schools in the Taranaki and Wanganui districts. With practically all the available schools in Taranaki engaged in club work there is now really no room for much further extension so far as this district is concerned; but in the Wanganui region a large number of schools from Marton to Taihape were brought into the scheme during the past year. Competitions on lines similar to those of preceding seasons were conducted. Crop-growing was carried out in both North and South Taranaki and Wanganui, while competitions for calf-rearing were also conducted in the two former districts.

CALF-REARING.

The number of calves judged for the past two seasons was as follows: —

	1927.	1928.
North Taranaki	117	154
South Taranaki	283	344

Each succeeding year has shown a decided improvement in the general condition of the animals brought forward for judging. It may be taken that the competition is bearing fruit in that the competitors are adopting better methods following on the lessons learnt each year. Following on the increasing entries the list of judges has been considerably enlarged in each district, as judging now takes from a fortnight to three weeks to complete. The improvement in the calves being brought forward has also meant that championship judging at one centre has had to be resorted to. With so many good calves it has been impossible to separate them unless judged together, and the group winners in both the type and condition classes are now brought to one convenient centre and the championship animals there selected. The two classes for "light" (Jersey-Ayrshire) and "heavy" (Shorthorn-Friesian) breeds were adhered to as in the past.

In both of these classes there are two distinct competitions, one for condition and the other for type. While recognizing the importance of type, the competition is chiefly concerned with the rearing of the calf. The word "condition" appears to create a wrong impression in the minds of some farmers, who hold that dairy stock should not be allowed to carry any condition. With dairy stock, however, condition does not imply an animal carrying a large amount of surplus flesh, but one in a sound healthy state, in working or milking condition. So it should be with the club calves—condition not being interpreted as fat and ponderous, but meaning a well grown, bright, healthy, well cared for calf.

Judging was carried out during the latter part of November and early December, points being awarded on the same basis as in previous

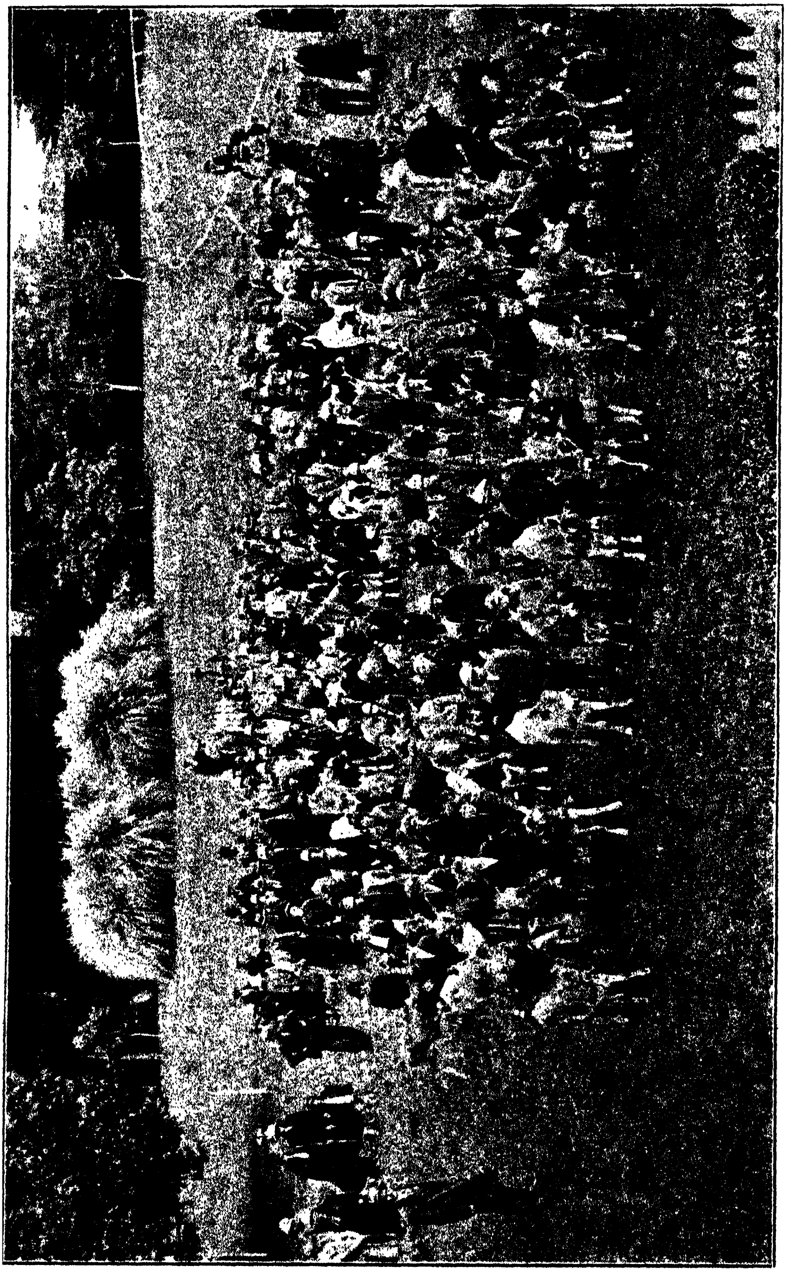

FIG. 1. GENERAL ASSEMBLY OF COMPETITORS FOR CALF CHAMPIONSHIP JUDGING AT ELTHAM.

years. During the group judging, which is carried out at the various schools, every advantage is taken of the opportunity it presents to give demonstrations in connection with dairy stock to the competitors and parents, who usually assemble in large numbers. It is felt that these demonstrations form one of the most important parts of the competition, and the judge's comments and remarks are closely followed by both children and adults. With a view to continuity the competitors are encouraged to bring animals previously judged for further judging, and during the season under review thirty-three animals, ranging from yearlings to four-year-olds, were presented in this way.

FIG. 2. EIGHTEEN-MONTHS-OLD HEIFERS PRESENTED FOR SECOND JUDGING AT MIMI SCHOOL.

Under the system practised the young animals are not lost sight of as they develop.

In North Taranaki the championship for the Jersey-Ayrshire class was won by Norman Marsh, of Mangorei; and in the Friesian-Shorthorn class the animal reared by Roy Hicks, of Tikorangi, was placed champion. The champion dairy-type Jersey-Ayrshire class heifer was that reared by Eric Spencer, of Upper Mangorei; while Eileen O'Byrne, of Egmont Village, won the type championship in the Friesian-Shorthorn class. In South Taranaki the championship for condition in the Jersey-Ayrshire class was won by R. Anderson, of Toko; while E. Betts, of Okaiawa, won in the Friesian-Shorthorn class. The dairy-type champion in the Jersey-Ayrshire class in this district was won by H. Schnebelli, of Tokaora; and that for the Friesian-Shorthorn class by Ray Shannon, of Cardiff.

CROP-GROWING.

The season of 1927–28 was probably one of the worst, so far as crop-growing is concerned, that has ever been experienced throughout the Wanganui-Taranaki region. A comparatively dry spring was followed by an abnormally dry summer, and early autumn was not conducive to heavy yields. The droughty condition was probably most severe in the coastal districts of North Taranaki.

The crops grown were mangolds and carrots in both Wanganui and South Taranaki, and mangolds and chou moellier in North Taranaki. In this latter district the soils vary very considerably, and it was felt that by continuing with root crops only the interest and value of the work was flagging in those localities where roots could not be successfully grown. In replacing carrots by chou moellier it was hoped that new interests and hopes would be revived. In this success was met with, and it has been pleasing to see schools on poorer soils coming well to the fore in these competitions. The further growing of two varieties of mangolds in North Taranaki also created new interests—not only with the competitors but with their parents. The roots grown were as follows: Wanganui—Mangolds (Prizewinner); carrots (Matchless White). South Taranaki—Mangolds (Prizewinner); carrots (Matchless White). North Taranaki—Mangolds (Prizewinner and Long Red).

The failure of a large number of plots to see the season out is still a matter of concern, although the climatic condition during the past season were responsible as regards many of the crops other than mangolds. That this latter crop lived up to its reputation as a withstander of dry conditions is proved by the heavy yields obtained. The destruction of plots by stock is still a regrettable feature and will, in many instances, remain so for many years. Unfortunately, the interest taken by some parents is not great enough to ensure that the child's plot is stock-proof.

FIG. 3. CHAMPION CROP OF MANGOLDS GROWN BY H. WILLIS, MATAPU.

This crop gained first prize for South Taranaki, and won the Stewart Wilson Cup championship for the Dominion. The grower is seen on right.

The outstanding success of the year was the splendid mangold crop of 188 tons 7 cwt. per acre grown by H. Willis, of Matapu School. Twenty-one crops weighed out at over 100 tons per acre, and a large number at over 90 tons. The average yield in South Taranaki was 71 tons 12 cwt., from sixty-five crops; in Wanganui 62 tons 10 cwt., from forty-eight crops; and in North Taranaki 46 tons 2 cwt., from forty-seven crops.

The results for the championships were as follows, the places referring to schools in each case:—

	Tons.	Cwt.
North Taranaki :—		
Mangolds :		
1st, V. Penwarden, Tataraimaka	127	2
2nd, Doris Jupp, Tikorangi	90	9
3rd, E. Corlett, Ratapiko	98	0
Chou Moellier :		
1st, J. Brown, Norfolk Road	59	3
2nd, J. Dryden, Egmont Village	42	18
3rd, R. Giles, Urenui	43	7
Best-kept plot : R. Gyde, Egmont Village.		
South Taranaki :—		
Mangolds :		
1st, H. Willis, Matapu	188	7
2nd, A. Muggeridge, Auroa	130	3
3rd, R. Bird, Ngaere	117	0
Carrots :		
1st, L. Philpott, Ohangai	58	16
2nd, C. Treweek, Matapu	53	16
3rd, R. Tapp, Ohangai	47	17
Wanganui :—		
Mangolds :		
1st, A. McCandish, Ngaturi	134	0
2nd, M. Trembath, Ngaturi	130	19
3rd, M. McCandish, Ngaturi	127	8
Carrots :		
1st, N. Munro, Ngaturi	55	5
2nd, W. Ell, Waverley	47	8
3rd, E. Trainor, Ngaturi	51	2

It will be noticed that in some cases the weight figures do not coincide with the placings, but in these cases the differences were brought about by a difference with some other marks, probably for chart.

Exhibitions of the roots grown by competitors were again staged at the Wanganui, Hawera, and New Plymouth winter shows, and were very favourably commented upon.

CHALLENGE TROPHIES.

The Stuart Wilson cup for the most outstanding performance in connection with boys' and girls' clubs throughout the Dominion was won for 1927–28 by H. Willis, of Matapu, South Taranaki. The Henry Lane and Co. Dominion challenge shield for the greatest number of points in club work was won by the Tikorangi school, North Taranaki.

Senior Clubs.

The season under review was the second in which senior clubs had been in operation in South Taranaki, and the first in North Taranaki. These competitions, which form an intermediate stage between the

junior clubs and the farmers' competitions, lend themselves to experimental and demonstration work, and, distributed as they are over a wide range of soil and climatic conditions, the results are of considerable interest. In South Taranaki two crops were grown—Prizewinner mangolds and Matchless White carrots—and there was a total of twenty entries. In North Taranaki the competition was confined to Red Intermediate mangolds, with twelve entries.

The trial carried out in South Taranaki comprised the use of kainit with mangolds and sulphate of potash with carrots. In the case of both crops the whole plot was sown with a phosphatic manure mixture, and then half of the plot given an extra dressing of kainit at the rate of 3 cwt. per acre for mangolds, and of sulphate of potash at 1 cwt. for carrots. The average yields worked out as follows:—

	Tons.	Cwt.
Mangolds—		
Phosphatic manure	56	0
Phosphatic manure and kainit	54	0
Carrots—		
Phosphatic manure	39	13
Phosphatic manure and potash	42	7

In North Taranaki the whole ¼-acre plot was given a dressing of the standard phosphatic manure and then divided into quarters, one quarter receiving kainit at the rate of 3 cwt., the second quarter 30 per cent. potash at 2 cwt., the third quarter muriate of potash at the rate of 1 cwt., and the last quarter left as a control. The trial gave the following per-acre results:—

	Tons.	Cwt.
Control	42	11
Kainit	46	11
30 per cent. potash	40	7
Muriate of potash	45	7

The competition winners were as follows:—

	Tons.	Cwt.
South Taranaki:—		
Mangolds:		
1st, A. Philpott, Ohangai	99	6
2nd, R. Harding, Ohangai	77	19
3rd, R. Corlett, Awapuna	71	10
Carrots:		
1st, H. Feather, Manaia	44	2
2nd, W. Dakers, Manaia	40	8
3rd, H. Symes, Auroa	38	17
North Taranaki:—		
Mangolds:		
1st, J. Corlett, Ratapiko	82	5
2nd, L. Goodrich, Mangorei	58	18
3rd, A. Phillips, Mimi	53	10

As in past years, the hearty co-operation between teachers, instructors, and supervisors did much towards the success of the season's operations.

Manufacture and Export of Casein.—During the year ended 31st March last 1,771 tons of lactic and 462 tons of rennet casein, making a total of 2,233 tons, were manufactured for shipment, as compared with 1,613 tons lactic and 151 tons rennet casein for the previous year. The annual report of the Dairy Division states that the quality of the casein continues to be uniform and of a high standard.

POTATO-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926–27.

METHODS OF APPLICATION OF FERTILIZERS.

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IN continuation of the experiments on phosphate, potash, and nitrogen manuring of potatoes previously carried out (see *Journal*, February, 1927), five further trials were made in the 1926–27 season. Two of these trials were largely concerned with methods of applying the fertilizers used.

The practice of sowing artificial fertilizers in the row with the seed potatoes (referred to herein as "manure with seed") has of recent years been replaced largely by the drilling of the manures through every coulter of the manure-drill prior to sowing of the seed. This latter method will be referred to here as "predrilling," and may be termed "manuring of the ground" as against "manuring the seed." No reliable information on the relative merits of the two methods was available, so it was decided to test the point on two farms. Both experiments were conducted in the same way, except that in one case predrilling was done eight days and in the other twenty-three days before planting; also, in the first case the potatoes were ploughed in and the manure with seed applied by hand, while in the latter case planting was done with a machine.

The treatments used were as follows:—

	Quantity per Acre.
(1) No manure.	
(2) Superphosphate, 44/46 per cent. tricalcic phosphate	3 cwt.
(3) Super 3 cwt., and sulphate of ammonia (20 per cent. nitrogen) 1 cwt., per acre	4 cwt.
(4) Super 3 cwt., sulphate of ammonia 1 cwt., and sulphate of potash (48 per cent. K_2O) 1 cwt., per acre	5 cwt.

METHOD OF EXPERIMENTS.

Predrilling of fertilizers was done in parallel strips, each ½ chain wide by 3 chains in length. Four strips of each of the treatments specified above were sown, hence there were sixteen parallel strips each ½ chain wide and 3 chains long. To ensure uniform cultivation the empty drill was run over the no-manure strips in the same way as on the manured ones.

Later the same manures were applied with the potatoes, which were planted in rows running across the sixteen ½-chain-wide strips. Each plot was three rows in width and replicated six times. This resulted in sixteen different treatments, each of which occurred twenty-four times over the area. Fig. 1 illustrates the arrangement diagrammatically.

Digging was done by hand, the rows being marked off into ½-chain lengths (corresponding to width of predrilled plots). Sorting into various grades was carried out with a potato-sorting machine.

Manures Predrilled (4 replications)

Manures with Seed. (6 replications)

	No Manure	Super 3 cwt.	Super 3 cwt +Sulphate of Ammonia 1 cwt.	Super 3 cwt. +Sulphate of Ammonia 1 cwt. +Sulphate of Potash 1 cwt.
No Manure	1 No Manure	5 S (Pd)	9 S + S of Amm. (Pd)	13 S + S of Amm. + S of Potash (Pd)
Super 3 cwt.	2 S (W S)	6 S (Pd) S (W S)	10 S + S of Amm. (Pd) S (W S)	14 S + S of Amm + S of Potash (Pd) S (W S)
Super 3 cwt. Sulphate of Amm. 1 cwt.	3 S + S of Amm. (W S)	7 S S + S of Amm. (Pd) (W S)	11 S + S of Amm. (Pd) S + S of Amm. (W S)	15 S + S of Amm + S of Potash (Pd) S + S of Amm. (W S)
Super 3 cwt. +Sulphate of Amm. 1 cwt. +Sulphate of Potash 1 cwt.	4 S + S of Amm. + S of Pot (W S)	8 S (Pd) S + S of Amm. + S of Pot. (W S)	12 S + S of Amm. (Pd) S + S of Amm. + S of Pot (W S)	16 S + S of Amm. + S of Potash (Pd) S + S of Amm. + S of Potash (W S)

← 3 rows →

← 33 feet →

Abbreviations:— Pd = Manure predrilled. W S = Manure with seed. S = Superphosphate, 3 cwt per acre.
S of Amm. = Sulphate of Ammonia, 1 cwt. per acre. S of Pot. = Sulphate of Potash, 3 cwt. per acre.

FIG. I. DIAGRAMMATIC PLAN SHOWING ARRANGEMENT OF POTATO MANURIAL TREATMENTS.

Each treatment replicated twenty-four times in each experiment. Treatments are numbered 1 to 16 in left top corner each section. Quantities of manure per acre range from 3 cwt. to 10 cwt. of mixture in Treatment 16.

Experiment 1: On Farm of S. McIntosh, Kaiapoi.

Manures predrilled, 18th and 19th October, 1926. Crop planted, 26th and 27th October. Potatoes ploughed in and manures with seed applied by hand (Figs. 2 and 3). Variety: Dakota. Previous history of field: 1925–26, wheat; 1924–25, potatoes, which followed a twelve to fifteen-year-old pasture.

OBSERVATIONS DURING PERIOD OF GROWTH.

In early December all rows having had manure with seed showed a stronger growth than the controls. The super plots were decidedly pale in colour as compared with those that received nitrogen, which were quite a deep green. At this time the predrilled manures did not show any visible effect on growth.

On 13th January the predrilled manures were having an easily discernible effect on growth of tops (Fig. 4), and from this time onwards both methods of application of the fertilizers appeared to be equally effective as measured by appearance of the tops.

The plots which received nitrogen were much more healthy and vigorous in appearance than those having super alone. The latter still maintained a better growth than the no-manure plots.

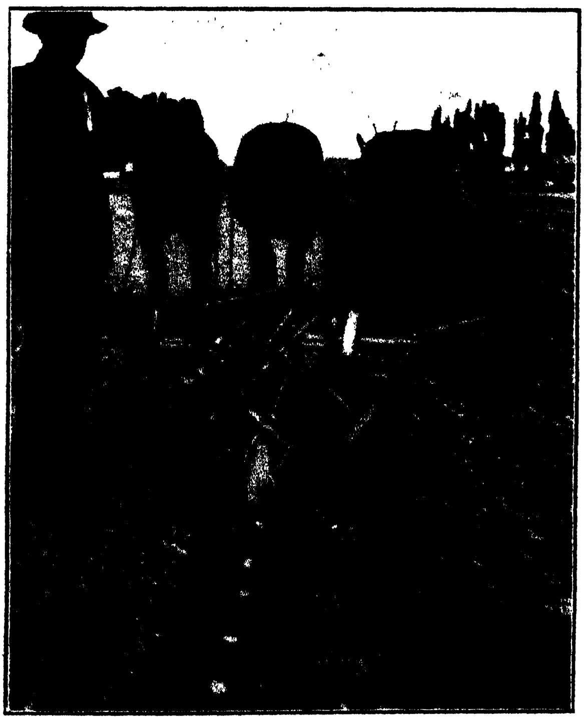

FIG. 2. PLOUGH WITH DISK ATTACHMENT FOR MAKING SMALL FURROWS IN POTATO-PLANTING.

Used for planting experimental crop on McIntosh's farm; manure was applied evenly along small furrow.

FIG. 3. APPLYING MANURES BY HAND IN McINTOSH'S EXPERIMENT.

Manures were weighed out in small quantities sufficient for one row 2 chains long. Uniform distribution was assured by spreading the manure a little more lightly than required, the remainder then being evenly distributed over that already applied.

FIG. 4. TYPICAL PORTION OF EXPERIMENTAL CROP ON McINTOSH'S FARM, IN JANUARY, 1927, SHOWING EFFECT OF VARIOUS TREATMENTS AND METHODS.

The following table summarizes the results of the experiment:—

Table I.—Results of Experiment on Farm of S. McIntosh, Kaiapoi.

No. of Treatment.	Treatment (see Fig. 1).	Yield in Tons per Acre. Table.	Seed.	Small.	**Total.**	Cost of Manures per Acre.	Profit from Use of Manure.
1	No manure	5·88	2·59	0·56	9·03	..	..
	Manures with Seed.					£ s. d.	£ s. d.
2	Super	7·24	2·73	0·54	10·51	0 18 0	3 7 0
3	Super + sulph. of amm. ..	7·51	3·25	0·68	11·44	2 0 0	3 17 0
4	Super + sulph. of amm. + sulph. of pot.	7·69	3·22	0·69	11·60	2 18 0	3 9 0
	Manures predrilled.						
5	Super	6·80	3·07	0·74	10·61	0 18 0	2 11 0
6	Super + sulph. of amm. ..	6·76	2·93	0·64	10·33	2 0 0	1 2 0
13	Super + sulph. of amm. + sulph. of pot.	6·76	2·92	0·74	10·42	2 18 0	0 3 0
	Super with Seed on Predrilled Manures named below.						
9	On super	7·22	3·09	0·69	11·00	1 16 0	2 19 0
10	On super + sulph. of amm. ..	7·64	3·11	0·72	11·47	2 18 0	3 2 0
14	On super + sulph. of amm. + sulph. of pot.	7·56	3·12	0·71	11·39	3 16 0	2 0 0
	Super + Sulphate of Ammonia with Seed on Predrilled Manures named below.						
7	On super	7·34	3·31	0·77	11·42	2 18 0	2 10 0
11	On super + sulph. of amm. ..	7·78	3·42	0·76	11·96	4 0 0	2 18 0
15	On super + sulph. of amm. + sulph. of pot.	7·82	3·40	0·78	12·00	4 18 0	2 2 0
	Super + Sulphate of Ammonia + Sulphate of Potash with Seed on Predrilled Manures named below.						
8	On super	7·38	3·25	0·72	11·35	3 16 0	1 13 0
12	On super + sulph. of amm. ..	7·55	3·15	0·66	11·36	4 18 0	0 18 0
16	On super + sulph. of amm. + sulph. of pot.	7·57	3·32	0·71	11·60	5 16 0	0 7 0

Notes.

In estimating the monetary return from each treatment the following values per ton are assigned to the various grades: Table, £3; seed, £1 10s.; small, no value. From £4 to £4 10s. per ton is reckoned to be the local average of the past seven or eight seasons' values of table potatoes for May delivery. Digging and cartage costs are about £1 to £1 10s. per ton, according to the conditions of digging and distance of cartage to rail. Hence £3 per ton seems a reasonable value to assign to table potatoes in the ground. Seed will vary in value from nothing to £6 or £7 per ton according to the demand, variety, and purity. From £2 10s. to £4 is considered a fair average market value to give this class of potato, and, as the costs in digging and handling will be about the same as for tables, seed are valued at £1 10s. per ton in the ground. Since small (pig) potatoes are generally left on the ground they are here considered valueless.

The *per ton* charges enumerated will be practically the same whether the crop is one of 10 tons or one of 11 tons. On the other hand, *per acre* costs, such as ploughing, cultivating, moulding, &c., will vary per ton, decreasing with increased yield and increasing with decreased yield. Such operations, however, cost the same per acre for manured as for unmanured crops.

Costs of manures: These have been calculated on the following approximate prices per ton: Superphosphate, £6; sulphate of ammonia, £22; sulphate of potash, £18.

Profit resulting from use of manures · The amount in this column represents the value of the increase over no manure less the cost of the manure (for example, treatment 2, super, 3 cwt., with seed). Thus 7·24 tons table potatoes at £3 per ton are worth approximately £21 14s., and 2·73 tons seed at £1 10s. are worth £4 2s., a total value of £25 16s.; deducting cost of 3 cwt. super at £6 per ton, 18s., there remains a net amount of £24 18s. per acre. The value of the crop on the no-manure plots is £21 11s. per acre. Hence there is a £3 7s. greater return as a result of using 3 cwt. of super.

COMMENTS ON TABLE 1.

To facilitate comparison of the results of the various treatments Table 1 is divided into six parts, the principal considerations being embodied in the first three parts. The necessary comparisons in these parts have been examined statistically, and where significance occurs it will be indicated. The numbers in brackets given below indicate the number of treatment referred to (see Fig. 1).

Manures with Seed.—Super (2) has given a significantly higher yield of about 1½ tons of table potatoes than no manure. The seed and small do not differ significantly in the two treatments. The difference in total yields is about 1¼ tons in favour of the super.

Super + sulphate of ammonia (3) is significantly better than super (2) in all grades.

Treatment (4) containing potash does not differ significantly from treatment (3), and in any case it has not increased the monetary return.

Manure predrilled.—Super predrilled (5) is poorer in yield of table potatoes and better in yields of seed and small than super with seed (2), although the totals do not differ significantly. The effect of difference in yields of the various grades has quite a marked influence on net profit as shown in the last column, treatment (2) giving 16s. per acre better return. This provides a very excellent example of the necessity of the determinations not only of total yield but of the yields of the different grades.

Super + sulphate of ammonia (9) and super + sulphate of ammonia + sulphate of potash (13) have both yielded significantly lower in table, seed, and total than the corresponding treatments (3) and (4) applied with the seed.

Of the three treatments predrilled it will be seen that any difference there may be is in favour of the super alone (5), and that both sulphate of ammonia and sulphate of potash have failed to increase the yield. In this experiment the method of applying the manure with the seed has proved the better.

Combination of Manures with Seed and Manures predrilled.—None of these treatments is of sufficient merit to have caused additional profit from its use, and although the heaviest yields have resulted from treatments (11) and (15) the cost of the heavy dressings of manure has lessened the resultant profits.

The consistency with which the mixture of super and sulphate of ammonia with seed has proved a little better than the super alone, irrespective of what the predrilling treatment consisted of, can be seen

if treatments (3), (7), (11), and (15) are compared with (2), (6), (10), and (14) respectively.

Effect of Treatments on Percentages of various Grades.—The percentage yields of table potatoes throughout have proved to be very consistent, and range from 64·1 to 66·6, with the exception of the super with seed, treatment (2). In this case the yield of table potatoes was 68·9 per cent. of the total yield. It proved to be significantly higher than the no-manure plots, which gave 65·1 per cent. of tables. The super (2) gave a correspondingly and significantly lower percentage of seed and small kinds. The super had 26·0 per cent. of seed and 5·1 per cent. of small, while all other treatments ranged from 27·1 to 29·0 per cent. of seed and from 5·8 to 7·1 per cent. of small.

Experiment 2 : On Farm of H. McLenaghen, Killinchy.

Date manures predrilled, 7th October, 1926. Crop planted with potato-planter on 30th October. Variety: Up-to-Date. Previous history of field: Grass for several years.

OBSERVATIONS DURING GROWING-PERIOD.

From the time that the plants appeared above ground a marked superiority of the plots having manure with seed over no-manure plots was apparent. The predrilled manures showed no effect until some time after the crop was through, and on 11th January, 1927, these plots appeared to be just as strongly grown as those having manure with seed. All plots having sulphate of ammonia and sulphate of ammonia + sulphate of potash were a much deeper colour than those having straight-out superphosphate. On 11th January the plots were very similar in appearance to those on McIntosh's farm (Fig. 4).

A complete summary of the results is given in Table 2 (next page).

COMMENTS ON TABLE 2.

Manures with Seed.—The very considerable and significant increase in the yield of table potatoes of about 1½ tons as a result of using super with the seed (2) provides a handsome margin of profit to the extent of £4 per acre.

The addition of sulphate of ammonia to super (3), although increasing the yields of seed, small, and total yield to a significant extent, has failed when the financial side is considered. The yield of table potatoes in treatment (3) is lower than that of super (2), although not to a significant extent. A further comment on this is made below. The mixture containing potash (4) has in no way improved the yield over that of treatment (3) when potash is omitted.

The superiority of the treatments (2), (3), (4) applied with the seed over the corresponding treatments (5), (9), (13), which were predrilled, is very obvious. In every case, except in the comparisons between the seed and small on the two superphosphate treatments, the differences are significant.

Manures predrilled.—Treatments (5), (9), (13) indicate that under this method of application both sulphate of ammonia and sulphate of potash have been instrumental in increasing the yield. Since the increases are far from being profitable they have not been submitted to statistical examination.

Table 2.—Results of Experiment on Farm of H. McLenaghen, Killinchy.

No. of Treatment.	Treatments (see Fig. 1).	Yield in Tons per Acre. Table.	Seed.	Small.	Total.	Profit from Use of Manure. £	s.	d.
1	No manure	3·78	3·32	0·51	7·61	..		
	Manures with Seed.							
2	Super	5·29	3·61	0·53	9·43	4	0	0
3	Super + sulph. of amm.	5·16	4·05	0·68	9·89	3	4	0
4	Super + sulph. of amm. + sulph. of pot.	5·18	3·79	0·69	9·66	2	0	0
	Manures predrilled.							
5	Super	4·30	3·51	0·58	8·39	0	18	0
9	Super + sulph. of amm.	4·61	3·43	0·57	8·61	0	13	0
13	Super + sulph. of amm. + sulph. of pot.	4·79	3·57	0·57	8·93	0	9	0
	Super with Seed on Predrilled Manures named below.							
6	On super	5·41	3·60	0·55	9·56	3	10	0
10	On super + sulph. of amm. ..	5·55	3·71	0·59	9·85	2	19	0
14	On super + sulph. of amm. + sulph. of pot.	5·99	3·70	0·52	10·21	3	7	0
	Super + Sulphate of Ammonia with Seed.							
7	On super	5·15	4·11	0·69	9·95	2	7	0
11	On super + sulph. of amm. ..	5·29	4·14	0·73	10·16	1	14	0
15	On super + sulph. of amm + sulph. of pot.	5·39	4·21	0·68	10·28	1	4	0
	Super + Sulphate of Ammonia + Sulphate of Potash on Predrilled Manures named below.							
8	On super	5·31	3·79	0·65	9·75	1	10	0
12	On super + sulph. of amm. ..	5·25	3·94	0·74	9·93	0	8	0
16	On super + sulph. of amm. + sulph. of pot.	5·58	3·77	0·67	10·02	0	5	0

Combinations of Manures with Seed and Manures predrilled.—Like the experiment on McIntosh's farm, some of the heavily manured plots have given the highest yields with, in the main, low monetary returns. The consistent effect of super + sulphate of ammonia applied with the seed in its relationship to super is again evident, although it has behaved somewhat differently than in previous experiments. Treatments (2), (6), (10), and (14), in which super has been applied with seed across all predrilling, are consistently higher in the yield of table potatoes and lower in seed, small, and total than (3), (7), (11), and 15 respectively, in which the nitrogen has been used. Hence the sulphate of ammonia, although increasing the total yield, has had the undesirable effect of reducing the yield of the more desirable table potatoes. Since the nitrogen has caused an increase in weight of crop, accompanied by a reduction of the number of tubers reaching the large size, it is obvious that there must have been a considerable increase in the number of tubers actually formed, and under more favourab conditions of growth a greater number of these could be expected

attain a greater degree of size. The rainfall figures given below give a good idea of the type of growing-period experienced.

Potash used with the predrilled treatments shows a regular increase in table potatoes, although in the case of the mixture applied with the seed (4) it has been quite useless. Each of the treatments (13), (14), (15), and (16) should be compared with that immediately above it. With the exception of treatment (14) none of the potash plots has given a better monetary return than the same treatment without potash.

Effect of Treatment on Percentage of various Grades.—The no-manure plots had 49·7 per cent. of table potatoes and 43·6 and 6·7 per cent. of seed and small potatoes respectively. In every case where super alone was sown with the seed the percentage of table potatoes was highest and the percentage of other grades correspondingly low. Treatment (2) gave 56·1 per cent. of table, 38·2 per cent. seed, and 5·7 per cent. small; treatment (6) gave 56·5 per cent. of table, 37·6 per cent. seed, and 5·9 per cent. small; treatment (10) gave 56·4 per cent. of table, 37·7 per cent. seed, and 5·9 per cent. small; treatment (14) gave 58·7 per cent. of table, 36·2 per cent. seed, and 5·1 per cent. small.

All the manured plots ranged from 51·3 to 55·6 per cent. of table potatoes, from 37·6 to 41·8 per cent. of seed, and from 6·4 to 7·4 per cent. of small. Hence all the manures increased the percentage of table potatoes and reduced the percentage of seed.

General Remarks.

The season under review was rather extraordinary in that the early summer was unusually wet and very favourable to growth, while the late summer was extremely dry. This is shown clearly by the following rainfall figures for Christchurch taken from the weather records published in the *Journal*:—

	Rainfall 1926-27. Inches.	Average Rainfall at same Station. Inches.
October	2·84	1·68
November	3·98	1·87
December	3·55	2·06
January	0·62	2·21
February	0·80	1·77
March	1·15	2·05

The dryness of the late summer caused crops to go off early, consequently the tubers did not develop, and crops in general produced a large proportion of seed and small tubers. Under the prevailing conditions the method of applying manure in the row with the seed gave much better results than predrilling. Whether this will be maintained in the future remains to be seen.

The effect of adding sulphate of ammonia to superphosphate was to increase the yield of all grades at McIntosh's (Kaiapoi), while at McLenaghen's (Killinchy) the increase has been in seed and small only, resulting, however, in a greater total weight per acre.

As in previous seasons, sulphate of potash failed to give results which warrant the recommendation of its use in Canterbury.

(To be continued.)

WAIMATE WEST DEMONSTRATION FARM.

NOTES ON OPERATIONS FOR YEAR 1927–28.

J. W. DEEM, Fields Superintendent, Wanganui.

THE season of 1927–28 in the Manaia locality was not of the best for milk production. The early spring was mild and cows started away well; then dry weather set in about the middle of September, with cold winds. This continued into November, when, about the middle of the month, fair rains were experienced. These were followed by drought conditions from the middle of December to the end of March. The dry conditions greatly affected the seasonal growth of grass, and were reflected in the herd production. To illustrate this, the butterfat returns for October were 1,894 lb., for November 1,844 lb., and for December 1,902 lb., with a drop to 1,594 lb. in January. This is the first time in the history of the farm that there has been a drop in butterfat in November, to be recovered in December.

The farm pastures were satisfactory during September and the early part of October, but, owing to the weather conditions mentioned above, they went off badly from the middle of October to the middle of November. A good recovery was shown in the early part of December, which lasted until the end of the month, from which date they became very bare and continued so until the end of March, after which there was a fair recovery. In the preceding year the grass-grub had been very bad on most of the farm. Careful feeding out of roots, ensilage, and hay was practised on the worst areas, and although the grass was thin on several of the pastures in the spring there has been a very good recovery, and unless a fresh attack is experienced during the current season the ultimate harm will not be great. At the same time it must be recognized that the carrying-capacity of the farm in the spring of 1927 was greatly reduced, and this to some extent accounts for the falling off in butterfat returns.

ROOT CROPS.

These crops consisted of 1 acre each of mangolds, carrots, soft turnips, and chou moellier. As in the past the sown crops had a great battle with fumitory and wild turnip. Most of the available labour on the farm was spent in weeding the mangolds and carrots in the early stages, and by the time the other crops received attention the dry weather had set in; consequently these crops were not very good.

The mangold and carrot crops made a wonderful recovery during March and April and yielded an average of 45 tons 10 cwt. per acre for carrots and 76 tons for mangolds. The carrots were only fair quality, but the mangolds were very good. A test between Matchless White and Sinclair's Champion carrots resulted in a win for the former with 46 tons 13 cwt. per acre, against 43 tons 4 cwt. for Champion. Red Intermediate mangolds were tested against Prizewinner, the yield weights being 87 tons 3 cwt. for Red Intermediate and 76 tons 1 cwt. for Prizewinner. Red Intermediate is a very fine mangold for this district and greatly preferable to Long Red or similar

varieties. The ideal practice would be to grow half of Red Intermediate and half of Prizewinner. The manure used for the carrots was three parts super and one part each of Nauru phosphate and bonemeal, at 4 cwt. per acre.

A mangold manurial trial was carried out with Prizewinner to test the various potassic manures, also to try the farm's standard mangold manure against Sulphurophosphate. The results were as follows:—

(Standard mixture: 3 parts super, 1 part Nauru phosphate, 1 part bonemeal.)

No. 1.

	Yield per Acre. Tons.	cwt.
Standard mixture 5 cwt.; kainit 3 cwt., per acre	76	1
Sulphurophosphate 5 cwt.; kainit 3 cwt., per acre	49	5
Increase in favour of standard mixture	26	16

No. 2.

	Tons.	cwt.
Standard mixture 5 cwt.; kainit 3 cwt., per acre	76	1
Standard mixture 5 cwt.; muriate of potash 1 cwt., per acre ..	68	19
Standard mixture 5 cwt.; sulphate of potash 1 cwt., per acre ..	61	12
Standard mixture 5 cwt.; 30-per-cent. potash 1 cwt., per acre ..	61	12

This bears out the results of numerous previous trials, which indicate that it is the salt more than the actual potash that has the beneficial effect on mangolds, and we can only reiterate our previous advice to use in addition to phosphatic fertilizer 3 cwt. to 4 cwt. of kainit or salt in preference to other potassic fertilizers. In this connection the approximate prices per ton of potash fertilizers may be noted as follows: Sulphate of potash, £16; muriate of potash, £15 10s.; 30-per-cent. potash, £7 15s.; and kainit, £5 10s.

TOP-DRESSING OF PASTURES: A POTASH EXPERIMENT.

Previous tests had failed to indicate any improvement, either to the eye or through preference by stock, where 2 cwt. kainit, 1 cwt. 30-per-cent. potash, or ½ cwt. sulphate of potash per acre, had been applied for several seasons in addition to the usual phosphatic top-dressings. A definite feeding test was therefore carried out. Fields 2, 3, 6, and 7, of 12 acres each, were subdivided into eight 6-acre paddocks, after having been given the usual phosphatic dressing of 3 cwt. per acre. Water was laid on to each field. Fields 2, 3, 6A, and 7A were then dressed with potash, Field 2 getting kainit, Field 3 30-per-cent. potash, Field 6A muriate of potash, and Field 7A sulphate of potash. Each field received sufficient of one or other of the different potassic fertilizers to give it 30 lb. of actual potash per acre. The control Fields 2A, 3A, 6, and 7 received at the same time an extra 1½ cwt. of super per acre, so as to about equalize the monetary value of the different dressings. Arrangements were then made to graze the dairy herd the full twenty-four hours on each field. The system followed was to graze the four supered fields in rotation, and then the four potash fields, then to return to the super, and so on through the season, giving the herd a fresh field every morning. This was continued from 15th September to 30th March. By grazing the cows twenty-four hours in each field no loss of fertility was suffered by any area, as is so often the case when different day and night paddocks

are used. The following table gives the amount of milk produced by each field for the period :—

	lb.		lb.
Field 2, kainit	24,208	Field 2A, phosphates only ..	24,126
Field 3, 30 per cent. potash	24,117	Field 3A ,,	23,919
Field 6A, muriate of potash ..	24,139	Field 6 ,,	23,801
Field 7A, sulphate of potash ..	24,007	Field 7 ,,	24,258
Total	96,471	Total	96,004

This gives an increase of 367 lb. of milk over a period of 6½ months in favour of the potash-dressed fields. A small increase such as this is not significant, however, and cannot be accepted as being in favour of potash or otherwise without further evidence. So far as could be seen by the eye there was no difference in grazing except in Field 7A, which appeared to be kept shorter than Field 7. In the autumn, after the March rains, the fields which had received the extra super looked much greener than those which had had the potash. Unfortunately, by the time there was a fair growth of pasturage from the autumn rains the herd was practically dry. These top-dressings have been repeated and the test is being continued this season.

LUCERNE.

Lucerne continues to do well on the farm. The area of 8 acres was cut in November for ensilage. Green feeding started early in January and continued up to the middle of April. In addition to providing green feed for the herd of forty-eight milking cows and several store animals during this period, about 4 acres of one cut was hayed. Had it not been for the lucerne, feed for the herd would have been very short during January, February, and March.

The practice of sowing 1 bushel of Algerian oats with 2 cwt. of super after the last autumn cultivation has been followed on this stand for the past five years—about two-thirds receiving the oats and one-third kept as a control. So far the lucerne has not shown any signs of deterioration from the addition of the oats. The oats provide good spring grazing if required, and they nearly double the weight of green material for the first cut in November.

PORTION OF THE RUAKURA STUD SOUTHDOWN EWE FLOCK WITH LAMBS.

SEASONAL NOTES.

THE FARM.

HAYMAKING.

WHEN mowing permanent pastures it is generally desirable—weather permitting—to cut early, aiming at a light cut of good-quality hay rather than a heavier cut later in the season. Early cutting conserves a closer turf on the pasture than later cutting, which leaves the cocksfoot-plants very tufted, the white clover stunted, and consequently a good deal of bare ground.

The green plants when cut for haymaking contain from 70 to 75 per cent. of water. Before they can be conserved as hay this water-content must be reduced to between 15 and 20 per cent. The wind and sun are relied on to dry the green material, and of the two the wind is most satisfactory. Leaving the cut grass too long in the upturned swathes is to be avoided, as this tends to excessive bleaching. The use of the swathe-turner is extending, and this machine has much to commend it. It lifts and turns the swathe without breaking it, and the quickness with which it works allows of frequent turning, and thus full advantage can be taken of the drying effect of the wind. Undue sun-bleaching is thus avoided and the colour retained in the hay. There is always a space between the swathes where the ground is drying, so that when the swathes are turned they go on to this bare dry ground, and this helps the drying process.

When hay is stacked a slight fermentation takes place, which gives rise to heat, and a certain amount of water is evaporated from the warm stack. The aim of the skilled haymaker is to have his hay at just such a state of dryness that only the initial stages of heating are reached. Frequently when rather green or moist material is stacked excessive fermentation and heating take place, and an inflammable gas is produced which is responsible for the spontaneous combustion of haystacks. Stacks having so great a diameter and height that the heat produced by fermentation cannot escape as quickly as it is liberated are liable to fire, if the material has not been stacked in the best condition. The centre of the stack rises in temperature till firing or smouldering occurs. The danger-point is the middle of the stack at about 6 ft. from the ground. Below this point the weight of hay above squeezes out the air and prevents fermentation, while above and around this the heat can escape to the outside. The heat will escape more readily from a long narrow stack than from one which, although containing the same amount of material, is shorter and wider. Stacks placed in sheltered corners near plantations are more apt to heat than stacks well out in the paddock and exposed to the wind.

The direct baling of hay from the field has recently been undertaken in some dairying districts, but this method requires settled weather at haymaking for its successful adoption. Under suitable conditions the method has several advantages over stacking. Less labour is required to harvest the crop. The bales can be more easily housed and covered than a stack, and consequently there is

less loss from the weather. There is less waste in feeding out, and the hay rations can be more easily measured and carted out to the stock. The baling plants in use can usually put through about an acre an hour, and the charge is about £2 per 100 bales weighing 70 lb. to 80 lb. each. The cost of baling is, roughly, 10s. per ton.

Corrugated roofing-iron makes a very efficient cover for a stack, and the loss in a well-built stack roofed in this way is less than 5 per cent., whereas the loss in uncovered stacks is often over 25 per cent. When the iron is placed so that the corrugations run parallel to the slope of the roof, some timbering is usually required to keep the iron in place. Probably as good a method as any is to join the sheets of iron together lengthwise in sections with ordinary spouting-bolts, so that each section is long enough to cover from one side of the stack to the other—the corrugations running parallel with the length of the stack. The iron should be weighted down by kerosene-tins filled with earth.

PASTURE MANAGEMENT.

The appearance of abundant rank grass in pastures at the end of November and in early December is frequently followed by a sharp drop in milk-yield by dairy cows. Every endeavour should be made to keep the grass short on dairying pastures, either by mowing the rank growth, or by adopting a definite rotational grazing scheme over part of the farm. Most dairying grassland has an average yearly carrying-capacity of nearly a cow to 2 acres, but during November and December the pasture is capable of carrying at least a cow to the acre. Accordingly in late October, when vigorous grass-growth starts, nearly half the farm should be shut up for hay and ensilage; once a good reserve of hay and ensilage has been built up the number of cows carried on the farm can be safely increased.

During November and December a careful grazing rotation should be practised, and the dairying pastures left closely grazed after feeding off. Under ordinary conditions the best plan is to run the cows in the best grass-growth during the day, and to clean up the partially grazed fields by using them as night paddocks. During November and December the few young stock that are carried on dairy farms are of little use to clean up the pastures when the grass is growing very vigorously. If a field gets away and the growth is quite uneven the field should be mown.

CROPPING OPERATIONS.

Roots ridged in October and November will require thinning during the coming month. A proper horse-hoeing preparatory to thinning is very important. Cultivators having three tines should be used—an A-shaped tine to work the middle of the drill and two L-shaped ones to cultivate near the rows. It is not advisable to use long, curved tines near the plants at the early hoeing, as they frequently knock too much earth away from the sides of the drills and leave the roots of the seedlings exposed.

The later sowings of swedes, soft turnips, rape, and other green crops will be made towards the end of December, and care should be taken that the final cultivation of the land does not dry the seed-bed too much. Care should also be taken not to apply too

much soluble manure with the seed for the later sowing of swedes and turnips, or the germination of the seed is likely to be erratic. Superphosphate and lime, or a mixture of super and slag or super and rock phosphate, usually give better results than when the whole of the phosphates applied are in the form of super.

On Canterbury and North Otago mixed farms the skim-ploughing of grassland for wheat can usually be commenced in December. Old short-rotation pastures usually throw little summer feed after November, and early skimming will not interfere to any extent with the carrying-capacity of the farm. Moreover, early skimming reduces the pressure of team work during the autumn months, and allows the wheat land to get the benefit of a partial summer fallow.

—*P. W. Smallfield, B.Ag., Fields Superintendent, Auckland.*

PREVENTION AND TREATMENT OF MAMMITIS IN DAIRY COWS.

The following practical points are commended to the attention of dairy-farmers :—

Prevention.—(1) Practice rigid cleanliness in all things. Pay particular attention to milking-machines and teat-cups.

(2) See that the machines are (*a*) running at the proper pressure and not too high, and (*b*) that they are not left on too long.

(3) All cows known or suspected to have anything wrong with the udder must be milked last by hand.

(4) Never strip an affected quarter on to the ground—always into a receptacle containing disinfectant.

(5) The early detection of mammitis cases is of the utmost importance, both from the preventive and curative points of view. This is best done by taking a strip or two of the fore milk from each quarter before putting the machines on. Take these strips into a bucket the top of which is covered with fine wire gauze. Any small clots in the fore milk are then immediately detected, and a cow whose milk contains them must be regarded as a case of mammitis and treated accordingly.

Treatment.—(1) Stripping : The most important feature of treatment is *frequent stripping*. This reduces the invading army of germs, and also removes the tissure-damaging substances which they produce ; moreover, by keeping the affected quarter as empty of milk as possible, the germs will be deprived of much of their food-supply. Stripping should be done at frequent intervals—the oftener the better. Even if it could be done every two hours it would not be too often—in fact, it would be very advantageous.

(2) Massage : This should be done thoroughly but gently, from above downwards towards the teat. Do it after stripping. Olive-oil or some simple, harmless lubricant must be used to prevent chafing the skin when massaging. When this is done, again strip out the milk that massaging has brought into the milk-cistern.

(3) Fomentation : This is particularly helpful in acute cases in the early stages. It is best done by applying a flannel wrung out in hot water, keeping the water hot throughout. Not less than half an hour should be spent in doing this. Afterwards rub in some olive-oil to ward off the effects of cold after fomentation. Avoid turning the cow out if the weather is bad or there is no sheltered place to put her in. Foment thrice daily while the quarter is hot and swollen.

—*Live-stock Division.*

THE ORCHARD.

SPRAYING WORK.

BLACK-SPOT may have put in an appearance in some localities, and it may be necessary on this account to continue spraying with lime-sulphur on certain apple and pear varieties. It may also be advisable to continue with bordeaux on such pear varieties as Winter Nelis, Louise Bonne de Jersey, and Williams. Otherwise one of the other forms of sulphur should be used on apples for mildew. When bordeaux is being used, particularly in the growing-period, care should be taken to secure a neutral or slightly alkaline mixture; it should never contain an excess of copper sulphate. If bordeaux is made correctly it should give no reaction to litmus paper. Free copper is quickly detected if a little of the mixture is placed in a saucer and a drop of ferro-cyanide of potassium is poured in, when it becomes muddy-brown in appearance. These precautions are very important, as many instances of scorching have been traced to the use of an acid bordeaux. The methods of testing are simple, and cost practically nothing.

Of the insect pests, codlin-moth, red mite, leaf-hopper, and pear-slug are the most troublesome, and should be watched for closely. Arsenate of lead must be renewed on pip-fruit every fourteen to seventeen days, to guard against codlin-moth and leaf-roller. Fruit infected with codlin-moth should be gathered and destroyed. Where lime-sulphur is used throughout the season red mite is kept in fair control. However, where sulphur in one of the other forms has been used in lieu of lime-sulphur it is frequently found that red mite increases to such an extent that special treatment has to be resorted to. The use of spraying-oils in the summer is becoming popular, and proving very effective in dealing with certain pests such as red mite. If red mite and leaf-hopper are both troublesome at the same time, spraying-oil 1–200, plus Black Leaf 40, 1–800, may be used. To get the best results this spray should be repeated ten days later. Oil up to a strength of 1–100 may be used with safety unless foliage is very weakened. However, the lighter oil gives less spotting of fruit, which sometimes occurs through the collecting of spray into drops at the base of fruits. A good deal of such spotting may be avoided if spraying is not left till late in the day, but done when drying may be quickly effected.

Cherries and plums will require perhaps two applications of arsenate of lead for control of the slug. The first application should be made as soon as the slug appears on the foliage, repeating it in about seventeen days. Stone-fruit may still require attention for brown-rot, according to weather conditions. Spraying measures as previously recommended should be supplemented by the removal and destruction of diseased fruit.

PACKING AND HANDLING OF THE STONE-FRUIT CROP.

Preparation should already be in hand for dealing with the new season's crop. By the end of November some of the earlier stone-fruit will be ready, and growers should look well ahead, particularly in the matter of case-supply. Good clean new cases should be used for stone-fruit particularly. Second-hand cases are often the means of brown-rot infection during transit. Clean packages, neatly labelled or stencilled, or branded with rubber stamps, and carefully packed, attract attention from buyers.

Often insufficient attention is given to the grading of stone-fruit. Blemished and misshapen fruits should be discarded, and, to allow of proper packing and to get uniformity in the case, fruit should be sized. Most sizes of peaches and nectarines and of the larger varieties of plums should be packed on the diagonal pocket pack system. Too often one sees fruit of all sizes tipped into a case, and the fruit bumped down to allow of nailing on the lid. The result is much bruising and many stem punctures. Such injuries should be strictly avoided. It may even pay to pack large-sized peaches of certain dessert varieties in trays, and to wrap each fruit.

Picking should be done carefully, and fruit handled as little as possible. Picking-boxes should not be overfilled, and picked fruit should not be left standing out in the sun. Picking should be done at the correct stage of maturity, avoiding under-maturity and over-ripeness. The correct stage for apricots, peaches, nectarines, and plums is what is described as hard ripe—that is, a degree of maturity which will allow the fruit after picking to develop good flavour and to ripen. In apricots it is indicated by a yellow tinge over the fruit ; in peaches and nectarines by the changing of the deep green ; yellow-fleshed varieties should show up golden on the sunny side. Cherries are harvested nearly ripe. Fruit fully ripe or almost so should be graded out and disposed of near at hand. Several pickings should be made to secure uniformity in maturity and to avoid over-ripeness.

THINNING.

The importance of thinning may be again emphasized. The careful thinning of apples will help materially in the work of grading for export. What some may consider an expensive operation really helps to lighten the work later on when time is more precious. Diseased fruits should be got rid of now. To secure the greatest uniformity in size, one must be able to judge the capacity of the branch or lateral and thin accordingly. Weaker trees require heavier thinning than trees in robust growth. Fruit should be removed from near the tops of leaders, and it is advisable to remove all fruit from young trees in order to secure their maximum growth.

EXPORT OF APPLES AND PEARS.

One cannot look too far ahead in connection with these matters. Prospective shippers should soon be able to estimate the crop and the probable amount of fruit for export, basing the percentage on previous seasons' experience. Cases should be made up in readiness, and provision made for a supply of all necessary materials in good time. Dry cases are absolutely essential. Cases made up from green timber dry best if stacked in the open. The grading-machine and other shed equipment may require some overhauling. One should not wait till the season actually begins to attend to such necessary details.

CULTIVATION AND MANURING.

Cultivation should be continued right through December. Early in the New Year green cover-crops may be sown, and those contemplating their sowing will be well advised to inquire for seed in good time. Nitrate of soda or sulphate of ammonia, 1 lb. to 1½ lb. per tree, may be applied to weakly trees or those showing signs of having received a set-back through previous heavy cropping or drought.

FIREBLIGHT.

Vigilance in connection with any possible fireblight outbreak should be exercised, and suspicious symptoms as described in last month's notes reported to the nearest Orchard Instructor without delay.

—*N. J. Adamson, Orchard Instructor, Hastings.*

Citrus Culture.

Lemons should be sprayed with bordeaux, 4-4-40, as the petals fall from the main flowering. This is very necessary to prevent verrucosis and grey scab, which otherwise distort many young fruits. Owing to the prolonged flowering-period, three sprays may be necessary to ensure the protection of all young fruits. A summer insecticide of oil, 1-60, Volck, 1-50, or Black Leaf, 40-1-800, is advisable to control insect pests such as young scales, aphis, and mealy bug. Black Leaf 40 may be added to the bordeaux and both applied together.

Every effort should be made to reduce the surface soil to a good tilth while the land is still in easy workable condition. Aim at providing at least 6 in. of very finely worked loose soil on the surface.

With the heavy spring growth on the trees will be found many strong growths of a very soft woody nature. These are rarely very fruitful, and, though they may serve a very useful purpose in the formation of young trees, with fruiting-trees they should be well cut back to send out side shoots, or cut out to the base if undesirably placed.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

PRIMING THE COCKERELS.

DECEMBER is one of the busiest months of the year on the poultry plant, for with the hatching operations over and little culling yet carried out the quarters will be taxed to their utmost capacity. It is indeed a time which calls for special care and management in every branch of the business. As the young stock develop the greater is the demand on the housing accommodation, and the possible risk of the birds becoming overcrowded.

To lessen the risk of overcrowding and its evil effect, particularly on the growing birds, the necessity of priming off all forward cockerels for the Christmas market cannot be overemphasized. Even when food is cheap it is poor economy to keep a cockerel after about five months old. If not marketed at about this age it will commence to produce its second feathers, and it may be months before it can be brought to a prime condition again. Another important point is that the flesh of a prime five-months-old bird is distinctly superior to that of one double the age, and will therefore command a much higher price, also a better return over the cost of production. The great benefit, however, in marketing cockerels at an

early age is that accommodation and runs are saved, which is distinctly to the advantage of the remaining stock, while more time is available to attend to the main working of the plant. Care should also be taken that the birds themselves as well as the quarters are free from vermin, as, however good the food may be, the birds will fail to rapidly put on weight if insect pests are present. The poultry-keeper, after going to the trouble of priming his cockerels, should endeavour to sell them by weight, and get away from the weak but common system of disposing of them by the pair. Many of the poulterers are prepared to buy by the pound, but of course they want something better than mere stores.

It is useless trying to prime cockerels when they are running with the pullets. The males should be separated from the females before commencing to crow. When the priming process begins, at about three and a half months, exercise must be curtailed. It is not necessary to coop the birds, as they are apt to fret and lose instead of gaining weight. The best plan is to confine them to small runs with little scope for exercise. Do not try to prime cockerels on inferior or damaged food. If they are to rapidly lay on flesh the food should be sound, and fed with a free hand. Only soft food should be given, and fed sparingly for the first two days. Hard grains are apt to bring on digestive troubles when the birds are confined to a limited space. A suitable mash may be made from two parts of bran and one part each of finely ground wheat-meal and maize-meal, the whole being moistened with milk or soup and mixed into a crumbly mass. Feed three times a day as much as the birds will eat up clean. Succulent green food can be fed in abundance, but separately, and when skim-milk is available it may be given in large quantities to drink.

MORTALITY THROUGH GIZZARD-COMPACTION.

Many cases have been reported to me lately of birds dropping dead at feeding-time from no apparent cause—birds which in most cases were in a heavy-producing condition and gave evidence of being healthy and thriving. I have made many post-mortem examinations in investigating this mortality. Usually the heart was found to be in a badly ruptured condition, and the gizzard packed with fibrous materials such as long pieces of grass, &c. No doubt the ruptured heart was the actual cause of death, but the question arises, "What caused the heart to rupture?" It appears safe to assume that this was due first to compaction of the gizzard with fibrous material causing derangement of the digestive system, then excessive blood-pressure resulting from excitement at feeding-time, followed by a ruptured heart. In several cases where my advice has been sought the cause of the gizzard-compaction was traced to the birds being freely supplied with long lawn-clippings. Lawn-clippings make an ideal green food for fowls when they are short and in a succulent condition. On the other hand, if they are on the long side and in a fibrous condition they form a tangled mass, and will not leave the gizzard. In other cases the mortality was due to the birds eating grass-hay which was used as litter, and this had a similar effect in packing the gizzard.

Once trouble makes its appearance in a flock from this latter cause the only safe course it to withhold from the ration as far as possible any grass, lucerne, green oats, &c., which is not in a succulent form and finely chopped. Indeed, the birds will be given a better opportunity of freeing themselves from any fibrous matter that may be contained in the gizzard if the green material provided consists solely of silver-beet, cabbage, rape, or similar tender plants. Above all it should be seen that plenty of sharp gravel grit is within reach of the birds at all times. Remember that fowls have no teeth, and require this grit to assist digestion.

BROODY HENS.

With the present high cost of foodstuffs as compared with the low market value of fresh eggs the poultry-keeper cannot afford to have any drain on his profits through weak or indifferent management. For example, there is nothing to be gained but much to be lost by allowing broody hens to sit on the nest for days on end. This not only means a loss in eggs, but the development of vermin is encouraged. It is a mistake to conclude that by allowing the hens to take a rest now they will make up for any loss in eggs during the dearer-egg season. If a bird is properly fed and maintained in good condition she needs no rest for the comparatively short laying-life demanded of her in these days of forced egg-production. Especially is it poor economy to now allow to rest hens which are intended to be disposed of at the end of the present laying season. As soon as a bird is found on the nest by night showing signs of a desire to sit she should be removed to a broody-coop. Do not make the common mistake, however, of starving broody hens or ill-treating them in any way as a short-cut to breaking the desire to sit. They should be given all the food they will eat, and encouraged by careful management to resume laying in the shortest time possible.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

ARTIFICIAL INCREASE.

MANY methods are in vogue relative to what is commonly termed "increase." The word "increase" in this case means adding to the number of colonies. Strong stocks are built up by early feeding, and then are divided, the portion containing the old queen being removed to a new location. As nearly as possible an equal part of brood and stores is given to each, and the remaining space is filled with frames of foundation. Early queens must be reared and introduced to the half that is queenless, or, failing this, a ripe cell should be inserted. For rapid increase this method is perhaps the best known in bee-culture, and is highly recommended. Always remember a good spring is necessary to ensure the young queens mating in time. If a large number of colonies are required those already divided may be further fed with sugar syrup or sealed stores, until

sufficient strength has been gained for a second division. Just here judgment is required as to whether some stocks are too weak for a second division, for only the very strong should be so broken down.

QUEEN-REARING.

During the summer months every attention should be paid to raising a stock of young queens to replace old and failing ones. Buying new queens each successive season is too expensive, and with a little attention and care good queens can be raised by the beekeeper in his own yard. An apiary should be requeened each year, and queens should not be tolerated for more than two seasons at the most. In the long-run it is the queens that tell in the production of big crops, and unless the beekeeper takes the trouble to requeen in the summer only a small percentage of the stocks will yield a surplus. Perhaps no branch of apiculture receives less attention than the production of young queens; and yet if the beekeepers who get the big crops of honey are asked what counts most in their production the reply is invariably "young queens." In New Zealand it has been proved over and over again that the best period for raising queens is from November to February. During these months everything is favourable for the operation, as the hives are at their highest state of prosperity, and under normal conditions the workers and drones are at their best.

It is best to breed only from pure Italian queens whose correct mating has been assured. Novices can judge the mating by noting the uniformity of the hatching brood as regards colour. Should the young worker bees show diversity of colour—some being yellow-banded and others quite black—the mating has not been correct. The question of mating is always a difficult one, as queens mate on the wing, and therefore it is impossible for the apiarist to select the sires. But as purebred queens, even though mismated, throw pure drones, it only takes a comparatively short time to eliminate crossbred drones from an apiary. There is, however, still the chance of contamination from other drones in the neighbourhood.

To sum up the matter: By persistently breeding from the best it is possible to achieve wonderful results, while under careless management, or, as is often the case, no management at all, bees are sure to deteriorate.

Methods of queen-rearing are legion, but may be roughly divided into two classes—namely, those which use the naturally built queen-cells, and those which necessitate the provision of artificial queen-cups into which young larvæ are transferred. The former method is most suitable for beginners, or for use early in the season, as it minimizes the risk of chill to young larvæ; while the second method is used largely by beekeepers who want to rear queens in greater numbers.

The Alley System.—A simple, efficient, and easy method for raising queen-cells may be found in the Alley plan. It must be understood, however, that when raising queen-cells they require to be large and well-shaped, and that any cells not up to size should be cut out. Procure a frame of young larvæ from the breeding-hive, and with a sharp knife proceed to cut every second row of cells down to the midrib of the foundation. Next kill two out of

every three larvæ, and cut the comb into strips about 1 in. wide the full length of the frame. These strips are fastened with melted wax to cell-bars that hang about midway in a standard frame. The cells are pared down to about $\frac{3}{8}$ in. in height, which gives the bees room to construct a solid base for the queen-cell. The frame or frames containing these bars, with the strips attached, may now be put into the hive previously prepared for their reception.

The Miller Method.—The Miller method of raising queen-cells will be especially useful to the novice or to the beekeeper wishing a few cells at one time. It is simple, easy, and under normal conditions never fails. No extra appliances are needed as described in the systems previously mentioned. Perhaps no better outline of the Miller system can be given than the original one which appeared in the *American Bee Journal* for August, 1912, as follows: "Into an empty brood-frame, at a distance of 2 in. to 3 in. from each end, fasten a starter of foundation about 2 in. wide at the top, and coming down to a point within an inch or two of the bottom bar. Put in the hive containing your best queen. To avoid having it filled with drone-comb, take out of the hive, either for a few days or permanently, all but two frames of brood, and put your empty frame between these two. In a week or so you will find this frame half-filled with beautiful virgin comb, such as bees delight to use for queen-cells. It will contain young brood with an outer margin of eggs. Trim away with a sharp knife all the outer margin of comb containing eggs, perhaps a few eggs next to the youngest brood. This you will see is very simple. Any beekeeper can do it the first time of trying, and it is all that is necessary to take the place of preparing artificial cells. Now put this 'queen-cell stuff,' if I may so call the prepared frame, into the middle of a very strong colony from which the queen has been removed. The bees will do the rest, and you will have as good cells as you can possibly have with any kind of artificial cells. You may think that the bees will start 'wild cells' on their own comb. They won't. At least, they never do to amount to anything, and, of course, you needn't use those. The soft, new comb, with abundant room at the edge for cells, is so much more to their taste that it has a practical monopoly of all cells started. In about ten days the sealed cells are ready to be cut out and used wherever desired."

NUCLEUS HIVES.

In order to facilitate the work of queen-rearing a few nucleus colonies should be run in conjunction with every apiary. In these small colonies queens can be raised and cared for until they are mated and laying. It is an easy matter, once the queens are laying, to transfer them to the larger hives in the apiary.

The best style of nucleus hive to adopt is the four-frame one. This size will give the young queen a chance to lay once she is mated, and will, besides, hold sufficient bees to care for relays of queen-cells throughout the season. To form a nucleus colony take one frame of well-capped brood with adhering bees, and one frame containing honey and pollen, the remaining space being filled with an empty comb and feeder. If the number of bees on the comb is not sufficient to form a good cluster, one or two frames of young bees may be shaken into the nucleus, this being done to replace the field-bees which return to the

old hive. Place the frame of brood in the middle of the hive and close the entrance until the following day, when the bees may be released. In the course of a day or two the small colony will settle down, and will then be ready to receive the first queen-cell.

Nuclei thus formed should be placed in a shady position until the bees are released. It is a good plan to set them a fair distance apart from each other and away from the main part of the apiary.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

SMALL-FRUITS.

GROWERS of berry fruits will now be busy harvesting their crops. The gooseberry and strawberry picking will be well under way, and the current and raspberry harvest about to commence. These facts might well be given more publicity by growers' associations. Very few people are aware of the brief period during which these popular berries are available. Were the people acquainted with the facts and a fresh supply made readily available, the consumption would increase greatly. To enable the berries to be supplied in the best condition picking must commence early in the day and the fruit be consigned that afternoon. A reasonably even sample should be maintained, both as to maturity and size.

Cape gooseberries and passion-vines should receive regular cultivation at a moderate depth only, in order to maintain a soil mulch, destroy weeds, and encourage growth.

TOMATOES UNDER GLASS.

Tomato-plants growing under glass will now be ripening their lower bunches. The leaves may be trimmed from below the ripening bunch. Make applications of liquid manure at frequent intervals, and now the houses are well filled with plant-growth see that ample ventilation is given in fine weather. The outside crop will now be well established. Suckering and tying should be done as soon as necessary and in fine weather shallow cultivation given between the rows.

VEGETABLE-GROWING.

In the vegetable section the harvesting of the early crops of potatoes, peas, cabbages, and salads will be taking place. A handy second growth may often be taken from this cabbage crop with a little management. When the growth is well established give the land a dressing of nitrate of soda. As the ground becomes available prepare it for winter crops of celery, leeks, broccoli, brussels sprouts, and savoy cabbage, and autumn crops of peas and beans.

Those cabbage-plants now in seed-beds are often troubled with insect pests during dry weather. This trouble is best combated by sturdy growth and ample watering. In difficult cases apply a spray consisting of two teaspoonsful of Black Leaf 40, 2 oz. arsenate-of-lead paste, and 4 gallons rain-water. Dilute the ingredients in a small quantity of water, and dissolve well before pouring them into the bulk.

Mix well, and apply the spray in dull weather when the plants are dry, covering well the under-side of the foliage, where most insects feed.

Celery is a waterside plant delighting in a rich soil. For this reason it is usually grown in trenches of rich soil, where it may be readily given abundant irrigation. Trenches for this purpose should now be prepared; usually they are made about 2 ft. wide to accommodate a double row of plants. Open the trench out 18 in. or so in depth, place a good layer of well-decayed manure in the bottom, mixing it well with about an equal quantity of soil, and topping off with 3 in. or 4 in. of soil alone. This should then form a shallow trench of the stated width. Water the plants well before setting them out. Lift them with plenty of soil, disturbing the roots as little as possible, and put out plants of an even grade. After planting, water the trench, and do not let it dry out while the crop is growing.

The useful, mild, and hardy leek is in general esteem during winter. It should be planted out now, as soon as the plants are ready, into a good rich soil. It is customary to drop the plants into holes made 5 in. or 6 in. deep with a dibber, the tops of the leaves just showing above the top. Afterwards fill the holes with water, which will wash down sufficient soil to establish the plants.

TOBACCO.

In the tobacco-fields, as soon as the ground crusts or shows a growth of seedling weeds, put the horse-hoes through the crop on a fine day, working the land to only a shallow depth. This treatment should maintain the necessary sturdy growth that is required. When the majority of the plants show flower-buds at the terminal the crop should be topped—that is, the terminal bud removed by pinching it out. This act maintains that growth and vigour in the leaves which would otherwise be absorbed by the blossoms.

Preparations for the harvest and curing the crop should now be made. A supply of 4 ft. curing-sticks will be needed, and materials for rafters on which to hang them. Arrangements should be made to clear right out the sheds that are to be used, so that the most may be made of the usually limited space available. The ample but controlled ventilation required to properly carry out this operation is usually satisfactory as far as the lower portion of the building is concerned, but the upper portion under the roof is often far too close. To enable a free draught to be obtained there when necessary, ample ventilation should be put in the roof or gable-ends.

—*W. C. Hyde, Horticulturist, Wellington.*

Survey of Weed Flora.—The last annual report of the Fields Division states that it is intended to make a survey of the weed flora of the seed-producing areas in New Zealand in relation to the occurrence of the weed-seeds in seed-samples, both undressed and machine-dressed. Work has been commenced on white clover, and arrangements have been made for the collection of samples of white clover from the principal seed-producing areas throughout New Zealand. Surveys of this type are in progress in many other countries, and prove of value in accurately ascertaining the place of origin of lines of seed.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JULY TO OCTOBER.

Dairy Division.

THE appended list, comprising particulars of 155 records, includes a number of very good performances. It will be noted that almost every class is headed by an outstanding yield, while some of the classes contain several records considerably above the average.

In the Jersey section the performance of Mr. J. J. Goodwin's three-year-old Rexcourt Lady Magnet attracts attention. Her yield of 880·19 lb. butterfat places her high among the leading producers of this class for the breed; in fact, the record is only some 25 lb. below that of Mr. P. J. Petersen's Ivondale Golden Lass, the present leader of the Jersey three-year-old.

NEW FRIESIAN SENIOR TWO-YEAR-OLD CLASS-LEADER.

The special feature of the current list is the record of Mr. T. Sheriff's Pareora Echo Blossom. Her C.O.R. for 819·81 lb. butterfat entitles her to the leadership of the senior two-year-old Friesians, a position which Mr. John Donald's well-known Netherland Princess IV has held since the 1913–14 season, the second year of certificate-of-record testing in New Zealand.

Pareora Echo Blossom was bred by Mr. A. S. Elworthy, of Holme Station, Timaru, one of our oldest C.O.R. testing breeders, and gained her certificate in the ownership of Mr. T. Sheriff, Clandeboye. The greater proportion of the pedigree of Pareora Echo Blossom is comprised of imported stock. Her sire is Rosevale Echo Burkeyje, and her dam Pareora Cherry Blossom, who gained a C.O.R. for 491 lb. butterfat at the age of 2 years 324 days. The paternal grandsire of Pareora Echo Blossom is Echo Sylvia Sir Griselda (imp.), who has to his credit ten C.O.R. daughters, eight with first-class and two with second-class certificates. The paternal grandam of Pareora Echo Blossom is North and Sons' Rosevale Burkeyje Sylvia, one of the many fine cows bred by these well-known breeders. Rosevale Burkeyje Sylvia has gained seven certificates of record, two on productions over 700 lb. butterfat, three on productions over 600 lb., and the remaining two on productions over 500 lb. This cow is a daughter of Burkeyje Sylvia Posch, and therefore a grandaughter of Inka Sylvia Beets Posch one of the outstanding sires of the breed. The maternal grandsire of Pareora Echo Blossom is Marquis Segis Colantha, sire of nine first-class and two second-class C.O.R. daughters, many good records being represented. The maternal grandam, Pareora Glommen, has a C.O.R. for 376·97 lb. butterfat on a record commenced at 2 years 318 days. Marquis Segis Colantha was sired by King Segis Wild Rose Homestead, and Pareora Glommen by Cliffside Butter Laddie, who in turn is by Cliffside Laddie.

Pareora Echo Blossom is thus a concentration of many well known and proven strains, and represents a combination of Canadian, American, and Dutch blood lines. She is still a young cow, and should be capable of still further outstanding performance.

LIST OF RECORDS: JULY TO OCTOBER, 1928.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Rydal Gipsy ..	T. M. Remington, Westmere	1 343	240·5	365	8,979·5	610·60
Oaklands Belle ..	F. Parsons, Whenuakura ..	2 23	242·8	365	7,709·3	533·34
*Middlewood Gold Leaf	Kilgour Sisters, Kiwitea ..	1 337	240·5	365	8,707·9	525·49
Earlston Iris ..	Chisholm Bros., Hunterville	1 344	240·5	365	8,781·2	522·51
Middlewood Clematis	Kilgour Sisters, Kiwitea ..	1 296	240·5	365	8,949·0	518·04
Gowanlea Trinket ..	John Robb, Westmere ..	1 331	240·5	365	9,731·1	502·04
Greendale Waihine ..	Mrs. G. M. Harris, Hikutaia	1 338	240·5	314	7,665·5	501·41
Hurden Lady Flora ..	H. Allen, Kihikihi ..	1 342	240·5	365	8,319·9	499·22
Earlston Charm ..	Chisholm Bros., Hunterville	1 346	240·5	365	7,790·1	493·66
Oaklands Lily ..	F. Parsons, Whenuakura ..	2 43	244·8	356	7,569·5	485·35
Awapuni Belle ..	W. Devine, Palmerston North	2 38	244·3	365	8,198·3	483·57
Noble's Maire ..	J. Hanaray, Woodville ..	2 19	242·4	365	8,851·2	457·66
Jersey Meadows Pennon	R. E. Robertstein, Rukuhia	2 52	245·7	361	7,859·9	451·34
Awapuni Lena ..	W. Devine, Palmerston North	1 353	240·5	365	7,338·1	448·64
Braithwaite Gold Dust	H. Allen, Kihikihi ..	1 303	240·5	365	8,119·2	447·56
Sunhill Topsy ..	J. G. Holmes, Te Awamutu	2 7	241·2	365	9,951·2	447·08
Flat Park Golden Mary	W. J. Hall and Son, Matatoki	1 314	240·5	365	8,087·9	438·56
Gowanbrae Lady Jean	R. E. Robertstein, Rukuhia	1 352	240·5	365	6,784·4	437·19
Ratavale Ideal ..	Mrs. I. W. Speirs, Levin ..	2 16	242·1	365	8,553·6	436·96
Otterburn Trinket ..	H. Allen, Kihikihi ..	2 29	243·4	363	6,945·0	430·16
Woodlands Mercedes Lass	L. Sampson, New Plymouth	1 288	240·5	365	6,806·4	429·21
Vernon Golden Eileen	G. R. and H. Hutchinson, Auckland	1 270	240·5	365	7,756·3	428·43
Glenview Melva ..	R. A. Paddon, Pukeatua ..	1 352	240·5	365	7,255·6	428·24
Ferns Marie ..	B. N. and W. A. Sandilands, Feilding	1 302	240·5	365	6,840·4	426·31
Ferns Freda ..	B. N. and W. A. Sandilands, Feilding	1 337	240·5	344	7,749·4	418·20
Princess Gay Girl ..	A. E. Sly, Whakaronga ..	1 360	240·5	348	6,935·3	403·74
Vernon Xenia's Star	G. R. and H. Hutchinson, Auckland	1 339	240·5	365	6,562·9	400·57
Falconite Daisy ..	E. W. Jacobs, Horotiu ..	2 26	243·1	336	6,617·5	397·26
Maggie's Madeline ..	D. Marra, Dargaville ..	1 335	240·5	362	6,535·9	383·56
Kelvin Melba ..	G. Buchanan, Paeroa ..	1 356	240·5	365	7,212·0	376·60
Wee Waa Princess ..	Mrs. G. M. Harris, Hikutaia	1 347	240·5	334	6,180·4	368·30
Poplarvale Bell Bird	G. R. and H. Hutchinson, Auckland	2 10	241·5	336	5,920·7	355·26
Kia Ora May ..	R. E. Clements, Dargaville	1 340	240·5	365	6,575·8	354·41
Tranby Corsica ..	H. Robson, Koromatua ..	1 319	240·5	310	6,685·2	351·12
Wareham Leonette ..	B. W. Seymour, Paterangi..	1 295	240·5	365	5,980·0	337·42
Rosebury Waione ..	H. Allen, Kihikihi ..	1 344	240·5	350	6,224·2	337·10
Golden Daylight of O.K.	G. R. and H. Hutchinson, Auckland	2 31	243·6	317	5,621·0	331·92
Brookley Model ..	E. W. Jacobs, Horotiu ..	1 314	240·5	326	5,983·8	331·10
Keepsake of Ivry ..	H. W. Le Bailly, Buckland	1 308	240·5	365	6,330·5	330·02
Ratavale Silver Bell..	Mrs. I. W. Speirs, Levin ..	2 35	244·0	352	6,359·8	329·74
Brentwood Fawn Bess	C. A. Willis, Pukekohe ..	2 31	243·6	350	5,550·9	324·03
Amelita	H. W. Le Bailly, Buckland	1 332	240·5	365	6,124·7	323·68
Titoki Foxie ..	H. Garlick, Makomako ..	2 33	243·8	333	7,132·7	321·59
Tyntesfield Snowflake	R. K. Garland, Okauia ..	1 344	240·5	355	5,302·4	320·78
Maxina of O.K. ..	Mrs. A. Jagger, Whitford ..	1 295	240·5	304	5,437·8	319·89
Bankton Nancy ..	F. P. King, Hautapu ..	1 358	240·5	343	5,549·3	316·67
Meadowvale Sweet Memory	W. Archer, Waikiwi ..	1 344	240·5	347	5,121·6	312·61

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season. Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Mission's Princess ..	Mrs. M. A. Wright, Hilton Downs	2 35	244·0	324	5,775·5	312·31
Heatherlea Neat Girl	D. A. Sinclair, Koputaroa ..	2 23	242·8	285	6,194·5	311·51
Jersey Meadows Dewdrop	R. A. Paddon, Pukeatua ..	2 8	241·3	316	5,663·4	300·86
Velebit Fox's Freda*	G. E. Yelchich, Waiuku ..	2 21	242·6	238	4,869·6	298·04
Jersey Farm Decoration	H. R. Benbow, Ormondville	1 280	240·5	251	5,400·2	284·23
Otterburn Marigold ..	R. K. Garland, Okauia ..	2 0	240·5	334	5,103·9	278·90
Ratavale Miranda ..	Mrs. I. W. Speirs, Levin ..	2 31	243·6	302	4,958·4	272·45
Alfalfa Serenade ..	R. A. Paddon, Pukeatua ..	1 323	240·5	282	5,011·2	258·18
Kelvin Patty ..	G. Buchanan, Paeroa ..	2 19	242·4	337	4,948·1	258·15
Tyntesfield Clarionette	R. K. Garland, Okauia ..	1 349	240·5	331	4,229·1	249·71
Brentwood Joyce ..	C. A. Willis, Pukekohe ..	1 352	240·5	289	3,765·3	248·35
Senior Two-year-old.						
Lisbury Zenith's Sultana	M. A. Jennings, Mauriceville	2 138	254·3	365	12,184·6	734·87
Palmdale Fleurette ..	D. Kennedy, Morven ..	2 210	261·5	365	9,900·3	592·21
Northland Merriment	E. W. Jacobs, Horotiu ..	2 113	251·8	365	11,011·0	536·17
Someview Belle ..	A. Clarke, Whareora ..	2 347	275·2	365	8,438·3	509·40
Lily of Stonycroft ..	S. Unwin, Winchester ..	2 300	270·5	365	9,018·8	468·85
Coniston Bilberry ..	R. Waterhouse, Ardmore ..	2 191	259·6	365	7,080·0	453·54
Orange Dale Rowers Peach	W. J. Hall and Son, Matatoki	2 315	272·0	324	7,034·8	448·23
Viola's Beatrice ..	R. E. Clements, Dargaville	2 269	267·4	365	8,489·2	439·78
Kitty of Bulls ..	Dr. F. J. Watson, Bulls ..	2 202	260·7	365	6,891·1	407·82
Llangollen Ladybird ..	J. T. Entwisle, Cambridge ..	2 243	264·8	365	6,483·0	389·11
Fairy Meadows Zealandia	F. S. Veale, Tamahere ..	2 239	264·4	358	7,225·9	364·22
Iron Lass	H. W. Le Bailly, Buckland ..	2 362	276·7	326	5,020·1	324·22
Tauwhare Lenora ..	Dr. C. G. Aickin, Auckland	2 321	272·6	365	5,070·4	310·43
Clifton Some Eileen ..	Mrs. A. Jagger, Whitford ..	2 103	250·8	264	4,865·2	286·21
Three-year-old.						
Rexcourt Lady Magnet	J. J. Goodwin, Morrinsville	3 342	311·2	365	15,065·7	880·19
Holly Oak Signorella	F. Phillips, Otorohanga ..	3 264	303·4	365	9,937·8	562·14
Rydal Blue Bell ..	T. M. Remington, Westmere	3 284	305·4	299	9,704·3	552·93
Elcho Faith ..	C. J. Masters, Hunterville ..	3 134	290·4	365	9,480·4	514·06
Linden Grove Bride	A. E. Sly, Whakaronga ..	3 359	312·9	365	9,359·5	510·29
Penrose Juliet ..	Clemow Bros., Stratford ..	3 293	306·3	332	8,929·7	507·93
Holly Oak Pansy ..	F. Phillips, Otorohanga ..	3 169	293·9	315	8,873·2	497·31
Silverleys Daisy ..	J. S. Jones, Bell Block ..	3 352	312·2	296	8,559·0	491·11
Neat Eileen ..	A. Clarke, Whareora ..	3 289	305·9	364	8,952·8	482·48
Mait's Lilac ..	F. P. King, Hautapu ..	3 19	278·9	337	9,160·1	477·87
Rosemont Melva ..	F. P. King, Hautapu ..	3 15	278·5	353	7,982·7	459·69
Ohape Eminent ..	H. W. Birch, Roxburgh ..	3 20	279·0	365	7,043·6	438·34
Meadowland Princess	B. W. Seymour, Paterangi	3 88	285·8	354	7,094·5	428·14
Ferndale May Star ..	J. J. Springgay, Gisborne ..	3 55	282·5	289	7,934·7	415·66
Baby Trix	J. Paul, Toatoa	3 239	300·9	277	7,955·4	397·63
Coniston Bluebell ..	R. Waterhouse, Ardmore ..	3 75	284·5	322	6,228·5	395·14
Ferndale Queen Beauty	J. J. Springgay, Gisborne ..	3 21	279·1	296	7,255·4	385·42
Penzance Dainty ..	F. P. King, Hautapu ..	3 14	278·4	365	6,246·5	374·69
Alfalfa Flower ..	Mrs. M. North, Ohaupo ..	3 44	281·4	282	7,596·3	359·45
Jersey Oak's Queen Bess	Mrs. I. W. Spiers, Levin ..	3 337	310·7	313	7,302·5	344·85
Clifton Some Rioter	Mrs. A. Jagger, Whitford ..	3 4	277·4	313	5,760·3	318·43
Rydal Jersey ..	W. C. Morgan, Marybank ..	3 26	279·6	250	4,384·7	289·35

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		JERSEYS—*continued.*				
Four-year-old.		Yrs. dys.	lb.		lb.	lb.
Otterburn Aster ..	A. C. Smith, Otorohanga ..	4 363	349·8	365	10,779·0	668·76
Ashleys Gem ..	W. T. Dazeley, Pukekohe ..	4 24	315·9	365	10,057·3	617·60
Ebors Susie ..	B. W. Seymour, Paterangi	4 4	313·9	351	9,496·1	505·97
Beaulah Pet ..	Mrs. A. Jagger, Whitford ..	4 314	344·9	309	7,644·1	462·29
Silverleys Teresa ..	J. S. Jones, Bell Rock ..	4 7	314·2	300	7,304·5	431·95
Kowhai Pearl ..	H. Garlick, Makomako ..	4 30	316·5	312	6,757·5	412·38
Holly Oak Pearl ..	A. V. Hornig, Manakau ..	4 288	342·3	285	8,657·9	378·75
Otterburn Silver Queen	A. C. Smith, Otorohanga ..	4 304	343·9	334	6,187·4	370·31
Holly Oak Queenie ..	L. A. McDonald, Levin ..	4 48	318·3	211	6,207·6	319·20
Mature.						
Jersey Park Fancy ..	D. Kennedy, Morven ..	7 11	350·0	361	12,137·6	728·48
Florrie's Hope ..	A. E. Sly, Whakaronga ..	8 284	350·0	365	12,909·1	639·50
Lively Prue ..	H. Lewis, Waharoa ..	5 342	350·0	346	10,773·3	632·42
Rioter's Gavotte's Pet	W. A. Guy, Matapu ..	7 6	350·0	360	8,417·5	574·10
Engdale's Grace ..	H. Allen, Kihikihi ..	8 346	350·0	365	10,465·8	573·78
Fair View Gift ..	E. Oakenfull, Tikokino ..	8 323	350·0	307	8,423·4	557·84
Brentwood's Snowdrop	C. A. Willis, Pukekohe ..	7 242	350·0	365	9,536·9	538·50
Mystery's Secret ..	R. J. Wilson, Putaruru ..	5 337	350·0	305	8,151·4	532·50
Mova's Una ..	R. K. Garland, Okauia ..	5 324	350·0	365	8,551·6	519·30
Ardmore Ada ..	W. T. Dazeley, Pukekohe ..	6 26	350·0	327	8,052·1	504·83
Clydesdale's Quicksilver	Mrs. I. W. Speirs, Levin ..	9 1	350·0	365	9,767·6	502·83
Hua Brook Dulcet ..	H. Salway, Bell Block ..	5 311	350·0	350	9,569·9	473·89
Clifton Rona ..	Mrs. A. Jagger, Whitford ..	5 58	350·0	311	9,005·1	459·69
Yellow Velvet ..	C. G. Wardell, Opaheke ..	9 332	350·0	294	8,072·2	444·69
Otterburn Dot ..	A. C. Smith, Otorohanga ..	5 338	350·0	326	7,777·7	431·93
Roslyn Sweet Love ..	Mrs. A. Jagger, Whitford ..	7 356	350·0	309	6,810·5	431·87
Rioter's Chase ..	Mrs. A. Jagger, Whitford ..	12 92	350·0	320	7,923·7	409·77
Raleigh's Success ..	A. E. Peppercorn, Cambridge	5 5	350·0	341	7,659·5	409·71
Silverleys Veronica ..	H. W. Birch, Roxburgh ..	6 3	350·0	345	5,875·6	396·89
Ribbonswood Primrose	E. Oakenfull, Tikokino ..	6 34	350·0	342	7,359·6	396·56
Waipiko Sprite ..	W. A. Guy, Matapu ..	10 355	350·0	331	7,958·9	372·47
Dainty's Surprise ..	D. and J. Gibson, Riverlea ..	5 314	350·0	288	7,960·4	359·27
Winter Beauty ..	E. Oakenfull, Tikokino ..	5 16	350·0	307	6,062·5	352·12
		FRIESIANS.				
Junior Two-year-old.						
Fairmont No. 16* ..	Halligan Bros., Te Aroha ..	1 356	240·5	365	17,898·6	643·00
Totara Sylvia Lulu* ..	Piri Land Co., Auckland ..	2 69	247·4	365	13,874·7	570·16
Fairmont No. 19* ..	Halligan Bros., Te Aroha ..	1 329	240·5	365	13,829·3	485·12
Fairmont No. 37* ..	J. L. Udy, Waihou ..	1 280	240·5	333	11,789·9	479·09
Melrose Sylvia Colantha Keyes*	T. Sheriff, Clandboye ..	2 12	241·7	248	12,493·7	451·50
Na Riwi Van Domino†	H. W. Reeve, Waitoa ..	2 43	244·8	269	10,843·6	353·96
Senior Two-year-old.						
Pareora Echo Blossom*	T. Sheriff, Clandeboye ..	2 223	262·8	365	22,671·9	819·81
Pareora Burke Maid*	A. S. Elworthy, Timaru ..	2 268	267·3	365	16,446·0	563·60
Pareora Segis Lass Posch*	A. S. Elworthy, Timaru ..	2 307	271·2	365	13,844·0	551·83
Junior Three-year-old.						
Mahoe Netherland Astelia	R. A. Wilson, Bulls ..	3 8	277·8	340	10,301·2	393·49
Carlowrie Duchess Sylvia†	R. K. Macdonald, Edendale	3 37	280·7	227	9,739·1	349·94

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS—*continued.*				
Senior Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Bainfield Sylvia Princess 2nd*	Piri Land Co., Auckland ..	3 291	306·1	365	19,621·7	736·87
Livingstone Lady Wakalona*	W. J. Eames, Hunterville ..	3 191	296·1	365	18,302·3	734·60
Junior Four-year-old.						
Ivy Netherland Pieterje	Hodgson Estate, Tamahere	4 8	314·3	365	16,934·1	564·10
Senior Four-year-old.						
Waipipi Princess* ..	W. T. Gleeson, Waipipi ..	4 257	338·2	364	15,479·8	679·38
Mahoe Adiantum ..	R. A. Wilson, Bulls ..	4 358	349·3	350	14,827·7	515·92
Mature.						
Nepean Isolda Johanna Pietje*	T. H. Richards, Cardiff ..	5 358	350·0	365	23,001·3	828·16
Matamata 156* ..	Piri Land Co., Auckland ..	6 317	350·0	305	19,427·0	716·28
Springfield No. 17* ..	J. I. Royds, Christchurch ..	7 106	350·0	365	20,564·8	711·56
Waipipi Desert Gold*	W. T. Gleeson, Waipipi ..	9 267	350·0	365	15,142·5	689·22
Carlowrie Beauty† ..	R. K. Macdonald, Edendale	7 92	350·0	200	12,767·2	410·85
		MILKING SHORTHORNS.				
Mature.						
Hauruia Esther ..	A. L. Souter and Son, Waerenga	Mature	350·0	294	12,744·6	589·04
Pukerimu Lucy 4th ..	Estate of Hon. John Fisher, Pukerimu	8 24	350·0	282	10,229·9	380·46
		AYRSHIRES.				
Mature.						
Elim's Pæony ..	A. R. Claridge, Toko ..	7 259	350·0	365	12,603·6	528·29
Prudence of Braeside	A. R. Claridge, Toko ..	6 343	350·0	365	12,554·3	509·97
Elim's Marvel ..	A. R. Claridge, Toko ..	5 341	350·0	308	9,738·0	405·91
		Second-class Certificates.				
		Jerseys.				
Three-year-old.						
Holly Oak Excelsior..	F. Phillips, Otorohanga ..	3 168	293·8	348	6,908·0	407·52
Mature.						
Holly Oak Sister Sue*	R. Weinberg, Nihoniho ..	5 273	350·0	365	13,388·8	810·30
		Friesians.				
Senior Two-year-old.						
Waipipi Daisy Gold*	W. T. Gleeson, Waipipi ..	2 223	262·8	365	12,528·7	492·58

Cider Manufacture.—The quantity of cider manufactured in the Dominion last season is estimated at 50,000 gallons, with an approximate value of £12,500.

EXPORT OF APPLES AND PEARS, 1929 SEASON.

I. CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee on shipments of apples and pears made from New Zealand during the 1929 export season are as follows :—.

1. The guarantee shall be limited to approved varieties and classes of apples and pears packed in compliance with the requirements of " Extra Fancy," " Fancy," and " Good " grades.

2. The Government guarantees to the grower a gross market price of eleven shillings (11s.) per case for " Extra Fancy " and " Fancy " grades, and seven shillings (7s.) for " Good " grade on all cases of such apples and pears exported by him in accordance with the conditions set out herein. (With respect to South American markets the gross price shall be considered to be the c.i.f. price, plus 1s. 6d. per case selling-charges.)

3. The guarantee shall be limited to apples and pears grown and shipped (otherwise than under an f.o.b. contract), by *bona fide* fruitgrowers or fruitgrowers' co-operative societies, through the New Zealand Fruit-export Control Board or other channels approved by the Minister of Agriculture.

4. Any grower who exports any portion of his fruit crop outside the guarantee shall be deemed to have forfeited his right to participate in the guarantee with respect to all fruit exported during the season by him or on his behalf, save that any grower, if he so desires, may ship the whole of his pears outside the guarantee without prejudice to his apple shipments under the guarantee, and *vice versa*.

5. All apples and pears to qualify for the guarantee must be passed by an Inspector of the Department, and must be packed in accordance with the Export Regulations, subject to the modifications and directions set out in the appended statement entitled " Export Regulations."

6. Payment of claims under the guarantee shall be calculated on the basis of the average gross price per case received by the claimant for the whole of the apples and pears approved under the guarantee and exported on his account during the season to all markets, and only the deficiency between the average gross price realized for such fruit and 11s. or 7s., as the case may be, shall be payable under the guarantee.

7. Where, however, apples or pears of more than one variety and supplied by more than one grower are exported by a joint packing company or group in its own name, the guarantee shall be calculated separately in respect of the whole of the fruit supplied for export by each grower, on the basis of the pool price received for each variety supplied by him ; provided that the joint packing company or group shall have, not later than seven days after the fruit has been shipped from New Zealand, notified to the Director of the Horticulture Division full particulars of each grower's fruit included in each shipment.

8. The Government reserves to itself the right (*a*) to withhold the guarantee from any grower who, in the opinion of the Director of the Horticulture Division, is not satisfactorily grading out, and exporting separately, his " Extra Fancy " and " Fancy " grade fruit ; (*b*) to withhold from any grower the guarantee with respect to any variety of " Fancy " grade or " Good " grade fruit in the event of the Director of the Horticulture Division being satisfied that such grower is not shipping a reasonable proportion of his higher grades of fruit of that variety ; (*c*) to withhold the guarantee from any grower who sells, except for consumption within New Zealand, any portion of his fruit crop without the approval of the Director of the Horticulture Division ; (*d*) to limit the quantity of fruit shipped to any particular port should freight rates or market conditions, &c., be deemed unsatisfactory ; (*e*) to insist on fruit being precooled prior to shipment if deemed necessary ; (*f*) to withhold the privileges of the guarantee from all fruit shipped in vessels the storage facilities of which are held by the Department to be unsatisfactory ; (*g*) to withhold the privileges of the guarantee with respect to any market in connection with which the New Zealand Fruit-export Control Board is of the opinion that satisfactory f.o.b. or c.i.f. trade is or can be established ; (*h*) to withhold the guarantee with respect to any fruit packed contrary to such instructions as may be issued by the Department of Agriculture, after discussion

with the accredited representative of the Fruit Control Board and the shipping agents of the fruitgrowers concerned, calling for a cessation of packing during any specified period, owing to the lack of shipping facilities or other causes; (i) to withhold the guarantee from any grower who resubmits fruit for export that has been previously rejected without having reconditioned such fruit as directed by an Inspector, or who resubmits such fruit other than as one complete line.

9. The Government reserves the right to re-examine and to withdraw any fruit from export in the event of such re-examination indicating that by reason of over-maturity or other cause inimical to the keeping-qualities of the fruit it would be inadvisable to allow such fruit to be exported. All fruit so withdrawn may be disposed of in New Zealand by the owner without reference to the guarantee, or by the Government on behalf of the owner. In the latter event the proceeds will be credited to the owner, and the transaction dealt with generally as though the fruit had been actually exported under the guarantee. But should such re-examination reveal the fact that any line of fruit, through careless or faulty packing, is decidedly below the standard required, it will be deemed not to be covered by the guarantee, and the owner of such fruit may, at the option of the Minister, be held to have forfeited all right to participate in the guarantee for the remainder of the season.

(NOTE.—No apples or pears carrying more than one-hundredth part of a grain of arsenic per pound shall be approved for export under the guarantee or otherwise.)

II. EXPORT REGULATIONS.

The regulations which follow shall apply to all apples and/or pears intended for export.

APPLE GRADES AND VARIETIES.

The standard grades shall be as under:—

"Extra Fancy," "Fancy," and "Good" grades: Apples of these grades shall be mature, sound, smooth, clean, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects. Individual apples of either grade shall carry not less than the percentage of colour, and not more than the percentage of blemish and unnatural russet indicated in the appended general list with respect to each variety in the respective grades.

Hail blemish allowance to be set by the Inspector in accordance with the nature of the hail damage in the locality.

Healed-over moth stings, with respect to export fruit, shall be limited as follows: "Extra Fancy," one sting; "Fancy" and "Good" grades, two stings.

Table 1.

XF = Extra Fancy; F = Fancy; G = Good; HCC = High characteristic colour; GCC = Good characteristic colour; CC = Characteristic colour.

Varieties.	Sizes. Max.	Sizes. Min.	Sizes. Min.	Colour.			Blemish.			Russet.		
	XF, F, G.	XF, F.	G.	XF. %	F. %	G. %	XF. %	F. %	G. %	XF. %	F. %	G. %
Solid Red.												
Hoover	100	234	252	65	30	10	3	3	5	5	10	20
McIntosh Red ..	113	234	252	65	30	10	3	3	5	5	10	20
Rokewood	113	234	252	65	30	10	3	3	5	5	10	20
Tasma	100	234	252	65	30	10	3	3	5	5	10	20
Partial Red.												
Brighton	113	234	252	40	15	5	3	3	5	5	10	20
Delicious	113	234	252	40	15	5	3	3	5	5	10	20
Dougherty	113	234	252	40	15	5	3	3	5	5	10	20
Edward Lippiatt ..	113	234	252	40	15	5	3	3	5	5	10	20
Frimley Beauty ..	113	234	252	40	15	5	3	3	5	5	10	20

Table 1—continued.

Varieties.	Sizes. Max.	Sizes. Min.	Sizes. Min.	Colour.			Blemish.			Russet.		
	XF, F, G.	XF, F.	G.	XF. %	F. %	G. %	XF. %	F. %	G. %	XF. %	F %	G. %
Partial Red.—contd.												
Jonathan	113	234	252	40	15	5	3	3	5	5	10	20
King David ..	113	234	252	40	15	5	3	3	5	5	10	20
Salome	113	234	252	40	15	5	3	3	5	5	10	20
Scarlet Nonpareil ..	113	234	252	40	15	5	3	3	5	5	10	20
Scarlet Pearmain ..	113	234	252	40	15	5	3	3	5	5	10	20
Shepherd's Perfection	113	234	252	40	15	5	3	3	5	5	10	20
Shorland Queen ..	113	234	252	40	15	5	3	3	5	5	10	20
Spitzenberg	100	234	252	40	15	5	3	3	5	5	10	20
Stark	113	234	252	40	15	5	3	3	5	5	10	20
Worcester Pearmain ..	125	234	252	40	15	5	3	3	5	5	10	20
Yate's	113	234	252	40	15	5	3	3	5	5	10	20
Striped.												
Adam's Pearmain ..	113	234	252	25	10	*	3	3	5	5	10	20
Cox's Orange ..	125	252	252	20	5	*	3	3	5	5	15	50
Premier	100	234	234	25	10	*	3	3	5	5	10	20
Ribston Pippin ..	125	234	252	20	5	*	3	3	5	5	10	20
Rome Beauty ..	113	234	252	25	10	*	3	3	5	5	10	20
Senator	113	234	252	25	10	*	3	3	5	5	10	20
Simmond's Winter ..	113	234	252	25	10	*	3	3	5	5	10	20
Statesman	113	234	252	20	5	*	3	3	5	5	10	20
Stayman's Winesap ..	113	234	252	25	10	*	3	3	5	5	10	20
Yellow or Green.												
Alfriston	88	198	198	HCC	GCC	CC	3	3	5	2	10	15
Ballarat	88	198	198	HCC	GCC	CC	3	3	5	2	10	15
Boston Russet ..	100	234	252	HCC	GCC	CC	3	3	5	2	10	15
Brownlee's Russet ..	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
Cleopatra	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
Celo	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
Dunn's	96	216	234	HCC	GCC	CC	3	3	5	2	10	15
Golden Pippin ..	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
Granny Smith ..	96	234	252	HCC	GCC	CC	3	3	5	2	10	15
Gravenstein ..	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
London Pippin ..	100	216	234	HCC	GCC	CC	3	3	5	2	10	15
Lord Wolseley ..	100	198	216	HCC	GCC	CC	3	3	5	2	10	15
McMahon's White ..	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
Newtown Pippin ..	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
Parlin's Beauty ..	96	198	216	HCC	GCC	CC	3	3	5	2	10	15
Pioneer	113	234	252	HCC	GCC	CC	3	3	5	2	10	15
Stone Pippin ..	113	234	234	HCC	GCC	CC	3	3	5	2	10	15
Sturmer Pippin ..	100	234	252	HCC	GCC	CC	3	3	5	15	50	75
Willie Sharp ..	100	216	234	HCC	GCC	CC	3	3	5	2	10	15

* Colour showing.

APPROVED FOR EXPORT TO CONTINENT OF EUROPE.

Table 2.

Variety.	Max. Size.	Min. Size.	Variety.	Max. Size.	Min. Size.
Cleopatra	100	198	Sturmer	100	198
Dunn's	100	198	London Pippin	100	198
Jonathan	100	198			

APPROVED FOR EXPORT TO SOUTH AMERICA.

"Extra Fancy" grade apples only shall be approved for South American markets as follows :—

Table 3.

Variety.	Max. Size.	Min. Size.	Variety.	Max. Size.	Min. Size.
		Solid Red Varieties.			
Rokewood	96	138	Tasma	72	138
		Partial Red Varieties.			
Delicious	72	138	King David	96	138
Dougherty	80	138	Salome	88	138
Frimley Beauty ..	72	138	Scarlet Nonpareil ..	88	138
Jonathan	96	138			
		Striped Varieties.			
Premier	80	138	Statesman	96	138
Rome Beauty	72	138	Stayman's Winesap ..	80	138

REGISTERED EXPORT NUMBER.

The registered number issued to all growers under the Local-market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit exported by him, provided that in the event of any group of growers pooling their fruit for export such group may designate its fruit by using any pool number allotted by the New Zealand Fruit-export Control Board. Likewise any packing organization to which a registered number has been allotted may use such registered number only provided that in either instance each individual grower's fruit is shown separately on the advice-note for examination, and stacked in separate lots, so that the Inspector may have no difficulty in identifying the particular lot under examination.

Should unavoidable circumstances prevent the adoption of this procedure resulting in a line comprising a large number of cases being submitted as one line, it must be definitely understood that the examination of same will be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line will be liable to rejection.

PACKING.

Plain or corrugated strawboard or wood-wool shall be used on top and bottom of cases.

WRAPPING PAPER.

Apples of the various sizes as set out below shall be wrapped in paper of the size indicated opposite each respectively :—

Sizes 64's to 80's (both inclusive), paper 11 in. by 11 in.
Sizes 88's to 113's (both inclusive), paper 10 in. by 10 in.
Sizes 125's to 198's (both inclusive), paper 9 in. by 9 in.
Sizes 216's to 234's (both inclusive), paper 8 in. by 8 in.

In the event of the size of the paper used being smaller than that specified above for any respective size of apples, such apples shall be double-wrapped by overlapping two papers.

SPECIFICATIONS OF APPLE EXPORT CASE.

Inside measurements: $10\frac{1}{2}$ in. by $11\frac{1}{2}$ in. by 18 in.

Ends: $10\frac{1}{2}$ in. by $11\frac{1}{2}$ in. by $\frac{3}{4}$ in.—two pieces (each planed on the outer side).

Sides: $10\frac{1}{2}$ in. by $19\frac{1}{2}$ in. by $\frac{5}{16}$ in.—two pieces (one board for each side).

Tops and bottoms: $5\frac{1}{2}$ in. by $19\frac{1}{2}$ in. by $\frac{3}{16}$ in.—four pieces (two each for top and bottom).

Cleats: 11½ in. by ¾ in. by 5/16 in.—four pieces (one across each end both top and bottom).

Cases made of two-piece sides and two-piece ends will be accepted provided the side boards are of equal width, and are cut or planed to an equal thickness, and that the grain of the end boards is across the end corresponding with the greatest measurement, and that the two pieces are properly secured by means of corrugated fasteners, one close to each edge on the one side, and one midway between on the reverse side.

Local timber recommended for the construction of export cases is white-pine of good quality; but *Pinus insignis*, rimu, and beech timber, if well and evenly cut and used with flexible tops and bottoms not exceeding 3/16 in. will be accepted.

Nailing: Nails used to be not less than 1½ in. long, 14 gauge. Nails to be spaced not more than 3 in. to 3½ in. apart, and the outer nails of each board to be not more than 1 in. from the edge of board.

Strapping: All cases to be strapped with a wire or steel band, such strapping to be tightly applied, and to be not more than 1 in. from end of case.

LABELLING AND MARKING.

Each end of each case of fruit intended for export must bear a label of one or other of the designs adopted by the New Zealand Fruit-export Control Board for the purpose of designating "Extra Fancy," "Fancy," and "Good" grades.

The marking of cases shall be in accordance with the previous season's requirements.

APPLES PACKED IN TRAYS.

Apples may be packed in trays in a manner similar to that prescribed for the packing of pears, provided that apples ranging in size from 100 to 163 per case of "Extra Fancy" grade only shall be so packed.

PEARS.

The following varieties of pears are approved for export to Europe:—

Table 4.

Variety.	Max. Size.	Min. Size.	Variety.	Max. Size.	Min. Size.
	In.	In.		In.	In.
Elizabeth Cole ..	2¾	2¼	P. Barry	2¾	2¼
Glou Morceau ..	2¾	2¼	Packman's Triumph ..	2¾	2¼
Josephine de Malines ..	2¾	2¼	Winter Cole	2¾	2¼
Keiffer	2¾	2¼	Winter Nelis	2¾	2¼
L'Inconnue	2¾	2¼	Vicar of Winkfield ..	2¾	2¼

PEAR PACKAGES.

Pears for export shall be packed in half-cases or trays of the following dimensions:—

Half Case.

Inside measurement, 11½ in. by 4½ in. by 18 in.
Two half-cases to be wired together, forming one package.

Specifications of Half Case.

Ends, 11½ in. by 4½ in. by ¾ in.—two pieces.
Sides, 19½ in. by 4½ in. by 5/16 in.—two pieces.
Tops and bottoms, 19½ in. by 5½ in. by 3/16 in.—four pieces.
Cleats, 11½ in. by ¾ in. by 5/16 in.—eight pieces.

Trays.

Inside measurement of 11½ in. by 18 in., with depth from 2¾ in. to 3 in. Each tray to be complete with lid and label. Three trays to be securely

wired together, forming one package. Binding-wires to be placed within 1 in. of each end of the package.

It is essential to the safe carriage of pears that the tray in all cases should be at least ¼ in. to ½ in. deeper than the greatest width of the fruit. Abundance of soft wood-wool should be used above and below the fruit. A cleat may be placed under the lid at each end when it is found necessary to increase the depth of a pear-tray.

Specifications of Trays in Sets of Three.

Ends: 11½ in. by 3 in. (or 2¾ in.) by ¾ in.—six pieces.
Sides: 19½ in. by 2¾ in. by $\frac{5}{16}$ in.—six pieces.
Tops and bottoms: 19½ in. by 5½ in. by $\frac{5}{16}$ in.—four pieces.
Tops and bottoms: 19½ in. by 5½ in. by $\frac{3}{16}$ in.—eight pieces (if desired, may be $\frac{5}{16}$ in., instead of $\frac{3}{16}$ in.).
Cleats: 11½ in. by ¾ in. by $\frac{5}{16}$ in.—four pieces.

In the construction of trays on the basis of sets of three to the package the following is recommended: Bottom of bottom tray and top of top tray to be of two pieces, each 5½ in. by $\frac{5}{16}$ in. Tops and bottoms in all other instances to be of two pieces, each 5½ in. by $\frac{3}{16}$ in. Middle tray to have cleats across each end both top and bottom, thus requiring four cleats ¾ in. by $\frac{5}{16}$ in. by 11½ in. Constructed in this way any bulge that takes place is inward, owing to the timber being lighter than the outer tops and bottoms. At the same time any such bulge is protected by the cleats, which also keep the trays apart, thus allowing for free ventilation.

N.B.—No pear of a smaller size than 33 to the tray shall be packed in trays.

LABELLING PEAR-TRAYS.

The same type of label will be used as was used last season (1928), but one end only of each tray will be required to bear a label, the other end to have the shipping number stencilled thereon.

After being packed and labelled, three trays will be wired together as one package of three trays, the centre tray to be turned the reverse end to the other two, thereby ensuring that the shipping number and other details will be shown on both ends of the package.

After the set of three trays has been wired the wire should be prized forward and stapled to the end board of the middle tray on both sides of each end of the package to prevent the trays from becoming displaced.

MINIMUM CONSIGNMENT.

Twenty cases of any one variety of either apples or pears shall be the minimum consignment accepted for export.

AGRICULTURAL SHOWS, SEASON 1928-29.

THE following show-dates have been notified by agricultural and pastoral associations:—

Wyndham A. and P. Society: Wyndham, 7th December.
Feilding A. and P. Association: Feilding, 5th and 6th February.
Tauranga A. and P. Association: Tauranga, 5th and 6th February.
Dannevirke A. and P. Association: Dannevirke, 12th and 13th February.
Te Puke, A. and P. Association: Te Puke, 13th February.
Masterton A. and P. Association: Solway, 19th and 20th February.
Whakatane A. and P. Association: Whakatane, 20th February.
Opotiki A. and P. Association: Opotiki, 23rd February.
Te Awamutu A., P., and H. Association: Te Awamutu, 20th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 6th and 7th March.
Morrinsville A. and P. Society: Morrinsville, 13th March.
Mayfield A. and P. Association: Mayfield, 23rd March.
Methven A. and P. Association: Methven, 27th March.
Flaxbourne A. and P. Association: Ward, 18th April.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DEATH OF LAMBS FROM SUSPECTED DOCKING INFECTION.

C. S. S., Ruataniwha :—

I have lost several lambs this season from a complaint which attacks the largest lambs. They become paralysed in the hind legs, and at times throw back their heads and become quite stiff. The lamb will drink if held up under the ewe, and the bowels seem to be functioning all right. The ewes have been on young grass and oats, with occasional changes on to old pasture. There have been no recoveries from these attacks. The lamb dies about the third or fourth day. Any advice as to treatment will be much appreciated.

The Live-stock Division :—

The description of the symptoms shown by your lambs is suggestive of infection occurring at docking. Such cases are very often of tetanic nature without actual locking of the jaws. Another cause giving rise to rather similar symptoms is the formation of an abscess in the spine, which can be very often located on post-mortem. Both those conditions are the result of infection through docking-wounds. Treatment is usually of no avail, and prevention must be aimed at by observing strict cleanliness in everything connected with marking. A clean site should be chosen for the operation ; the use of an antiseptic is very advisable ; and strict attention should be paid to cleanliness of knives, &c.

OCCURRENCE OF WING-THISTLE.

"SUBSCRIBER," Featherston :—

Can you tell me the best way of dealing with wing-thistle ? It is getting thicker every year in this part of the country. Is it likely to get serious, or will it die out in time ? The seed has been blown from the rough hills at the back of my place.

The Fields Division :—

If in small quantities wing-thistle can be controlled by chipping, but there are no economic means of controlling large areas. When the thistle becomes thickly distributed on a farm it is a nuisance for a year or two, after which it gets very much thinner and ceases to do any harm. On large areas in the South Island wing-thistle provides a great deal of sheep-feed. It is not likely to cause you any serious trouble.

DEHORNING OF YOUNG CATTLE.

"DEHORNER," Nelson :—

Kindly advise me on the following points : (1) Where circumstances make it impossible to prevent the growth of horns in calves, at what age should young cattle be dehorned ? (2) At what distance from the head should the horn be severed ? (3) Which is the best season of the year for the operation ?

The Live-stock Division :—

(1) Where the caustic method is not adopted on calves, it is preferable not to dehorn until two years old, as after that age there is less probability of horn-growth occurring. (2) The horn should be sawn off close to the head, taking a ring of hair about ¼ in. wide with the horn. This is preferable to leaving ¼ in. of horn, which frequently results in growth continuing and a malformed stub. (3) Dehorning should be performed in cool weather when flies are not plentiful.

ENSILAGE FOR CALVES.

"SUBSCRIBER," Fordell :—

Please inform me if weaner calves will thrive if fed on ensilage through the winter. Will they feed on it readily, and is there any danger of giving them too much at a time ?

The Live-stock Division :—

There should be no danger in feeding ensilage, provided it is fed with care and the calves gradually brought on to it. Precaution should be taken to see that the ensilage is not spoiled, or mouldy, and only as much should be given as will be cleaned up at each feeding. As ensilage is a succulent food the calves will eat it readily, but it is advisable that some hay be fed in conjunction.

CLUB-ROOT AND FERTILIZERS.

O.W.G., Marton :—

I am putting about 14 acres into turnips in land subject to club-root. I am told ½ cwt. of nitrate of soda to the acre will counteract this tendency. Please let me know if this is so, or advise me what manure would be effective.

The Fields Division :—

The use of nitrate of soda will not in any way counteract the tendency to club-root ; at present there is no known fertilizer which will prevent this disease. In your case the best fertilizer to use with the crop would be one-third super and two-thirds Ephos or Nauru phosphate ; basic super ; or half super half basic slag. The last-mentioned mixture is probably the best, but it must be mixed immediately before being put into the drill, and sown at once. If allowed to stand any time it gets hot and will not run through the drill.

TREATMENT OF BLOWN COWS.

"ANXIOUS," Havelock North :—

I have had a number of cows blown lately, and lost a valuable one yesterday through it eating burr-clover, which appears to be throughout the paddocks just now. Will you kindly advise what to do for the animals when blown, and in the event of having to stab them what sized knife should be used ?

The Live-stock Division :—

In the prevention of "bloating" of cows the following points should be remembered : (1) Do not turn cows in the morning on pasture containing much clover, until the dew is off the grass. (2) The feeding of some hay previous to turning cows on the pasture has a marked preventive effect. (3) Keep a close watch on the cows when first turned on pasture liable to cause bloating, as the condition is rapidly developed. (4) It is a good plan to allow cows on such pasture only for a very short period to begin with, extending the time daily. In this way they become gradually accustomed to the feed. Regarding treatment when blown, a useful drench consists of two to three tablespoonfuls of turpentine in a pint of raw linseed-oil. In extreme cases tapping of the paunch is necessary to save the animal's life. The puncture is made on the left side, at the point of greatest distension, between the last rib and the haunch-bone. The instrument for this purpose is known as a trocar and cannula, but if this is not available a long narrow-bladed knife can be used. After inserting the knife it should be turned in the wound to allow the gas to escape.

Paralysis in Pigs.—In recent experiments at the Wallaceville Veterinary Laboratory pigs suffering from paralysis made a good recovery when given a moderate quantity of cod-liver oil in their food.

WEATHER RECORDS: OCTOBER, 1928.

Dominion Meteorological Office.

GENERAL NOTES.

OCTOBER was characterized by rains in excess of the average in all parts of the Dominion, and in most districts the excess was considerable. The heavy falls, towards the end of the month especially, were of great value to the east coast districts, where a dry spell had previously been experienced. In parts of the South Island the absence of sunshine, following on the cold and dry conditions in September, prevented any rapid growth of vegetation, but in most districts feed is abundant and in excellent condition.

Although the rainfall was, on the average, above normal in all districts, there were isolated stations on both east and west coasts where slight deficiencies were reported. The greatest excesses occurred in the high country of the South Island and in Central Otago, where some stations had more than double the average. Hanmer Springs recorded 11·58 in. compared with an average of 3·31 in. Of the North Island provinces, Wellington had the greatest excess, while among individual stations Tauranga was outstanding with double its average fall.

Temperatures on the whole were mild, and the few cold spells of too short a duration to have a serious effect on vegetation. A few inland frosts occurred about the middle of the month, one on the 15th doing some damage to early-sown crops.

For the greater part of the month unsettled and frequently stormy weather prevailed. Depressions were numerous, and mainly of the westerly type. During the first ten days the westerly weather was particularly strongly developed, and gales from between north and west were of almost daily occurrence. The most violent were on the 5th, 6th, and 8th, and on the first two days much damage was done to buildings, fences, and trees in South Canterbury, the wind on the evening of the 6th being considered the severest experienced for many years in that district. Heavy rains fell on the ranges of the South Island. High levels were reached by the southern lakes, especially Lake Wakatipu, while many of the rivers were in flood. An unusual number of thunderstorms was reported. In the east coast districts warm and dry conditions predominated during this period.

A most interesting phenomenon associated with the strong winds between the 6th and 8th was that they transported enormous quantities of dust from Australia. Deposits of varying thickness were reported from almost all districts south from New Plymouth and Napier. In Otago and Southland the deposition occurred mainly on the 6th, and was particularly heavy. Snow on the mountains was tinted to a pale chocolate colour. The time of arrival of the dust-clouds became later and later as the distance from the southern extremity increased. Dust transported from Australia has been noted previously in New Zealand, but on this occasion the phenomenon was on a far greater scale, and a special investigation of it is being undertaken.

First northerly and then southerly gales were associated with an intense depression which crossed the Dominion on the 13th. Hail fell in places, and the ranges of the South Island received falls of snow.

From the 21st to the 26th and during the last three days of the month the weather was controlled by intense cyclonic disturbances. Except on the 28th, conditions were extremely unsettled, with general rains. South to south-east gales and very cold weather occurred at many places on the 30th and 31st. Heavy rains fell in the east coast districts, and there was some flooding in the North Island and in North Canterbury and Marlborough. In the Manawatu and Wairarapa districts the floods assumed serious proportions, and much of the low-lying country was under water. The cold temperatures were responsible for some losses of shorn sheep.

—*Edward Kidson, Director of Meteorological Services.*

RAINFALL FOR OCTOBER, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	4·90	16	0·66	4·48
2	Russell	4·08	13	0·77	4·64
3	Whangarei	6·91	16	2·17	4·96
4	Auckland	5·24	23	0·97	3·64
5	Hamilton	5·56	15	2·05	4·79
6	Kawhia	6·37	16	1·72	5·48
7	New Plymouth	5·97	21	0·98	5·61
8	Riversdale, Inglewood ..	10·78	23	1·74	10·37
9	Whangamomona	8·68	16	1·25	9·01
10	Eltham	5·24	15	1·26	4·11
11	Tairua	8·10	15	1·70	6·46
12	Tauranga	10·61	14	2·85	5·25
13	Maraehako Station, Opotiki	6·06	10	2·12	5·45
14	Gisborne	2·30	10	0·57	2·80
15	Taupo	8·09	16	1·88	4·48
16	Napier	3·04	13	0·75	2·30
17	Maraekakaho Station, Hastings	4·87	15	1·79	3·09
18	Taihape	5·70	22	0·94	3·99
19	Masterton	5·87	18	1·96	3·32
20	Patea	4·69	18	1·14	4·33
21	Wanganui	3·59	12	1·10	3·67
22	Foxton	4·81	13	1·13	2·92
23	Wellington (Karori Reservoir)	6·05	17	1·71	3·83
	South Island.				
24	Westport	11·13	25	3·27	6·97
25	Greymouth	8·75	23	1·40	10·03
26	Hokitika	15·21	23	2·22	11·84
27	Ross	20·31	21	3·41	15·16
28	Arthur's Pass	45·45	23	12.49	19·78
29	Okuru, Westland	18·75	18	2·50	15·37
30	Collingwood	14·01	25	3·16	11·03
31	Nelson	4·56	17	0·88	3·59
32	Spring Creek, Blenheim ..	4·45	14	1·90	2·72
33	Tophouse	8·44	21	1·00	5·90
34	Hanmer Springs	11·58	17	3·31	3·31
35	Highfield, Waiau	4·76	9	2·10	2·60
36	Gore Bay	2·98	10	1·08	2·25
37	Christchurch	2·27	12	0·78	1·68
38	Timaru	1·70	16	0·40	1·95
39	Lambrook Station, Timaru	4·68	12	1·06	2·01
40	Benmore Station, Clearburn	4·90	19	0·80	2·13
41	Oamaru	2·90	16	1·06	1·68
42	Queenstown	6·80	17	1·27	3·48
43	Clyde	3·71	14	0·72	1·58
44	Dunedin	5·80	20	1·32	3·09
45	Wendon	6·02	19	0·83	2·66
46	Gore	6·00	22	0·94	3·26
47	Invercargill	6·18	23	0·93	4·44
48	Puysegur Point	11·15	24	1·49	8·16
49	Half-moon Bay	8·98	22	1·52	4·94

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 84·61 per cent., compared with 87·28 per cent. last year. With 8,211,878 breeding-ewes in the North Island, as shown in the 1928 sheep returns, the number of lambs this season is estimated at 6,948,380. South Island and Dominion estimates will appear in next month's issue of the *Journal.*

ESTIMATED AREAS UNDER CEREALS AND POTATOES.

THE following estimates of the areas under wheat, oats, and barley in the Dominion for the current season were issued by the Government Statistician at date 3rd November, the figures being based on a card census: Wheat, 255,000 acres; oats, 303,000 acres; barley, 22,000 acres. The corresponding final totals for the preceding season (1927–28) were 262,799 acres of wheat, 303,708 acres of oats, and 21,752 acres of barley. Wheat, therefore, has an estimated decrease in area this season of 7,799 acres, oats a decrease of 708 acres, and barley an increase of 248 acres.

Also from a card census and at date 3rd November the Statistician estimates this season's area under potatoes as 21,100 acres. The corresponding final figures for the 1927–28 season were 21,693 acres. Only holdings of 1 acre and over outside borough boundaries are covered by these figures; a fair aggregate area of potatoes is also grown on smaller holdings and within boroughs. Reckoned on the average of the last five seasons—5·34 tons per acre—the total yield from this season's area would be 112,674 tons, as compared with a total actual yield of 121,402 tons for 1927–28.

KILLINGS AT MEAT-EXPORT WORKS.

THE following table, compiled from Meat Producers Board statistics, gives particulars of aggregate killings and/or equivalent output at meat-export works in New Zealand for the past five seasons:—

Season.	Beef Quarters.	Mutton Carcasses.	Lamb Carcasses.	Pork Carcasses.	Boned Beef = Freight Carcasses.	Frozen Sundries = Freight Carcasses.	Total Equivalent in 60 lb. Freight Carcasses.
1923–24	322,829	1,939,324	4,769,583	4,943	266,154	81,997	5,705,608
1924–25	458,549	2,224,263	4,750,164	35,753	263,738	54,961	6,438,056
1925–26	215,594	2,001,340	5,000,590	60,757	223,415	111,229	5,610,730
1926–27	184,331	2,094,354	5,381,121	74,633	242,044	69,534	5,956,708
1927–28	394,821	2,005,333	5,947,197	147,601	283,749	125,200	6,992,516

Examination of Basic Slag.—Referring, in his annual report for 1927–28, to the system of examination by the Imperial Institute in London of all shipments of basic slag exported from England and the Continent of Europe to New Zealand, the Chief Chemist, Department of Agriculture, states that during the last four months of the year samples of fifty-six consignments of slag were analyzed at the Institute, with the following results: Slag with minimum guarantee 17 per cent. phosphoric acid—Complied with guarantee, 42; below guarantee, 4: slag with minimum guarantee, 20 per cent. phosphoric acid—Complied with guarantee, 3; below guarantee 7. In only two instances, however, was the deficiency greater than 1 per cent. The importers of slag found to be below guarantee were notified of the Imperial Institute's results before arrival of the shipments. The citric-solubility of the basic slag was in all cases satisfactory. In one instance the fineness of grinding was slightly below the minimum guarantee of 80 per cent.

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NITROGENOUS FERTILIZING AND ROTATIONAL GRAZING OF PASTURES.

EXPERIMENT IN PIAKO COUNTY, SEASON 1927-28.

G. W. WILD, B.Ag., Instructor in Agriculture, Hamilton.

INTENSIVE GRASS-FARMING.

WITHIN the last two years many dairy-farmers in New Zealand have given their attention to the comprehensive work on grassland being carried out in Germany and England. Following the epoch-marking post-war experiments in Germany with soluble nitrogenous manures applied to grassland a widespread adoption of this method of forcing pasture throughout the year was forthcoming. The reports of results were generally astounding, the carrying-capacity of grassland being increased fourfold in some instances. This was due almost entirely to the great stimulation of grasses as distinct from clover.

A study of the experiments showed that an intensive system of pasturage had to be carried out to fully control the quick flush of grass induced by these soluble manures. Chemists by a wide series of analyses of pasture at different periods of its growth showed that grass when in the young succulent 4- or 5-in. stage was much richer in protein than grass at any later stage and that it ranked as a concentrated foodstuff. This, of course, had been generally known to agricultural scientists previously, and progressive and discerning dairy-farmers in this country knew from practical experience that short grass was the ideal for butterfat-production, while rank grass was left alone by milking-cows in an ordinary field. Here the cows had their choice and showed it for the shorter more succulent herbage, but if the animals were forced to consume rank grass they immediately dropped in milk-production.

Above all things the use of these highly soluble nitrogenous manures brought home the necessity for absolute control of grassland and the consumption of the grass in its immature state. This was only practicable by the subdivision of fields into such areas that a sufficient number of cattle could be brought to bear on the pasture to graze it down in one or two days when it was at the ideal stage of 4- or 5-in. high. It was shown that from eight to twelve cows per acre,

and even more, were required to do this effectively and quickly before the pasture became soiled. The number of fields had to be determined in order that a complete grazing rotational scheme might be inaugurated, so as to provide that each field would be grazed down when at the right stage. Dry cattle and sheep were utilized to clean up the fields after the dairy cattle had taken the " bloom " off the pasture. Such rank growth as then remained was mown off, and the field harrowed and closed until its next grass flush was ready.

There is no doubt that such control methods in grassland management are also capable of effecting a great increase in production per acre where only phosphatic fertilizers are used. It is not too much to state with regard to our dairying districts generally that the mismanagement of the grassland is our present stumbling-block. From November onwards the great majority of dairy lands are seen in varying stages of grass that has run to flower and seed-head. The loss in butterfat-production up till the end of December must be very great from this cause alone. Rectification must come by greater subdivision of these large fields into areas small enough to be properly controlled. To use soluble nitrogenous manures on large fields would not be practical, as proper control could not then be exercised—in fact, less control than before could be exercised. Subdivision and a proper water-supply are therefore more imperative with the new grassland manuring. Farmers must realize this point and use nitrogenous manures only on those fields that can be properly controlled. In this way knowledge of local conditions and the response from different fields under different climatic and seasonal conditions will be gauged, and such practical knowledge utilized to the best advantage in the future. The foundation on which a dairy-farmer must build is seen by every thoughtful man to be the adoption of the controlled paddock system. The farmers' aim will then be to manage his grazing in such a way that he can consume his grass at the 4- or 5-in. stage.

Compared with phosphatic fertilizers of proved worth, nitrogenous artificials purchased in New Zealand are very costly. The question of economy is therefore exercising the minds of thoughtful dairy-farmers. When it is considered that the use of phosphatic manures combined with effective tripod harrowing has produced such striking results this is only natural. At the present time 3 tons of superphosphate can be purchased as cheaply as 1 ton of sulphate of ammonia, the most widely known and used nitrogenous manure. The usual phosphatic dressing for grassland is 3 cwt. per acre per annum, but many farmers who have used double the quantity are convinced that the results are highly satisfactory. On most of the pumiceous Waikato and Thames Valley lands it would appear that the saturation-point for phosphates has not been reached with a 3 cwt. per annum dressing. On the other hand, the use of sulphate of ammonia and nitrate of soda has always been advised for the hay and ensilage crop. Such being the case, the returns from application of these manures should be greater when the grass is consumed at the 4- or 5-in. stage rather than as a mature crop of ensilage or hay.

Experiment at Manawaru, Piako County.

In order to study the effects on grass and the per-acre production of the two methods mentioned—namely, 3 cwt. of super plus several applications of sulphate of ammonia, compared with heavy applications of superphosphate—an experiment was devised and carried out last season on Mr. John Ward's farm, at Manawaru, Piako County. Selection of a farm which provided ideal conditions for such a trial was not easy, for it must be ideally laid out as regards its water-supply, number and size of fields, &c.

The sketch-plan of Mr. Ward's farm (Fig. 1, next page) shows the layout, &c., existing at the time the experiment was commenced. Relevant particulars are as follows: Area, 50 acres; number of fields, 8; number of cows, 27; butterfat till December, 1926, 4,111 lb.; butterfat till May, 1927, 8,043 lb. butterfat; per acre, 161 lb.

It will be seen that the farm is also a relatively high-production one. Of some thirty farms studied during 1926–27, the average production at Manawaru was only 122 lb. of butterfat per acre. The herd was composed entirely of big Friesian cattle, most of them pedigreed animals. The herd-testing association credited this herd with a production of 343 lb. butterfat per cow. The country is mainly reclaimed kahikatea swamp land, and hence fertile. The pasture is generally good, rye-grass predominating, with timothy, cocksfoot, crested dogstail, a little meadow foxtail, and white clover throughout. Weeds are not bad, but buttercup was general, with docks evident in the moister places. The farm had received 2½ cwt. superphosphate plus ½ cwt. 30-per-cent. potash salts, per acre, for the year, and in June, 1927, the whole area was top-dressed with 3 cwt. super per acre.

In view of the difficulty of obtaining correct production data from the various treatments during the early spring, when cows were calving daily and production was rapidly increasing, it was decided to make the first application of fertilizers just before the peak period of production. This was considered to be mid-November, and hence the manures were applied the first week in November. With the droughty conditions then obtaining this application was really a fortnight too late. Half the grazing area of the farm was top-dressed with 85 lb. of sulphate of ammonia, while the other half received 2½ cwt. of superphosphate per acre. Three fields were dressed with each treatment. The remaining two fields were closed to stock, one field for the hay crop, the other being spring-sown grass.

The grazing rotation decided upon commenced on 11th September. This was arranged so that the herd would be pastured for ten days on one half of the farm and ten days on the other half. Before the different fertilizers were applied each grazing-field was mown off, and the dry stock allowed to follow the herd and clean this up. There was very little top growth formed during this period, which showed that the grazing rotation had given excellent results. After the mowing of the fields buttercup came to flower quickly, but only crested dogstail and a little Yorkshire fog really seeded again to any extent. The white clover showed to advantage on the plain phosphated fields from Christmas onwards. The tripod and chain harrow also followed the mower, so that very even conditions were obtained over all the grazing-fields.

The full grazing period over the six fields was therefore twenty days. This period was arrived at after a study of the recovery period necessary to produce a 4- or 5-in. grass flush. It allowed three days' grazing on four fields and four days' grazing on two fields. With the

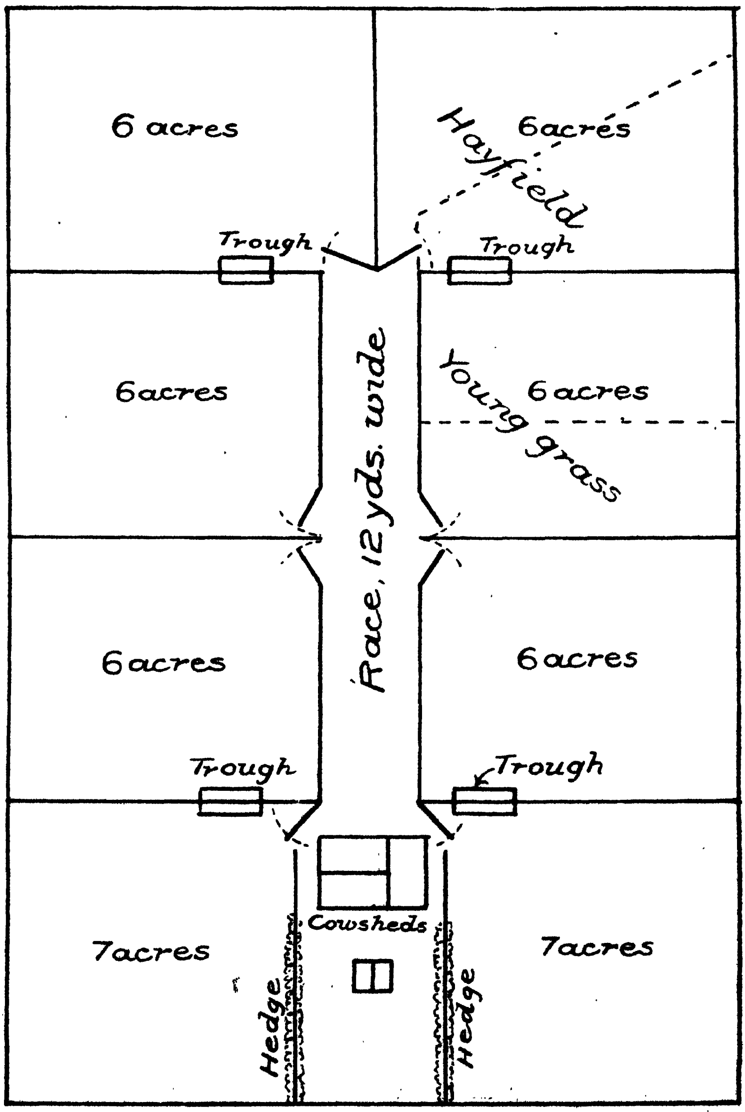


FIG. 1. SKETCH-PLAN OF MR. WARD'S 50-ACRE FARM, SHOWING SUBDIVISIONS, ETC.

The dotted lines in the areas marked "Hayfield" and "Young grass" indicate fences erected during season under review.

dry stock following the milkers, each field had six to eight days' grazing and fourteen days' spell in which to recover. During February the hay field and the young grass field were cut into two, giving a total of ten grazing-fields.

It must be stated here that there was an indication of a drop in milk-yield on the third and fourth days in the same field. Owing to the number of stock available for the size of the fields—namely, thirty-two cows and 6- to 7-acre fields—the stocking-capacity was only five to six cows per acre. With this light stocking three to four days' grazing was necessary on each field to get the full consumption of the best of the pasture. The rotation practised gave each field a spell of fourteen days between grazings. This length of time appeared about ideal during the spring and early summer. The grazing for the present season will be arranged to give a similar spell, or longer, as the case may be, to all fields to produce this 4- to 5-in. flush. The experience gained throughout the year has pointed to a maximum of two days on each field as being sufficient. Most of the fields have therefore been divided into half to allow of this. Some forty-two cows will be milked this season, and as the fields will range from 3 to 3½ acres only this will give a stocking of thirteen to fourteen cows per acre. It is considered that this heavy stocking will be ample to consume the 4- to 5-in. flush in from one and a half to two days at most. As practised last season, the dry stock will follow the dairy cows, and each field will be harrowed and mown off when necessary.

In practice it will be found that a set grazing scheme cannot always be maintained. Fields differ considerably in their pasture content and period of recovery, so that the fundamental principle of grazing off each field when it has reached the right height of 4 to 5 in. must guide the farmer in each case. On even country where the pasture is predominantly rye-grass the growth is very even, and the grazing will approximate a set rotation. It must be remembered also that this trial deals with converted kahikatea swamp country and a rye-grass-dominant pasture, hence its period of recovery and evenness of growth in different fields are typical only of such conditions. On cocksfoot-dominant country such evenness may not be apparent, and doubtless the recovery period will be longer. Every farmer has therefore his own particular problem to solve, but so long as he follows the principle of consuming his grass at the 4- or 5-in. stage he is on the right lines.

Following the application of fertilizers in early November a burning effect on the grass foliage was noticeable. This was more apparent on the ammonia-treated fields, and doubtless the clover suffered more on these areas. This point is worthy of consideration, as in practice it may be found in droughty seasons that the November-December applications of ammonia may seriously affect the autumn clover growth. This point is being carefully studied, and some more definite information should soon be available. During the summer, with the dry conditions at their worst, all the fields suffered badly, but the ammonia-treated areas showed the effect more. Two weeks after the application of the sulphate of ammonia the vivifying effect was noticeable in the pastures, and this response was indicated to some extent in the butterfat returns. It must be remembered that conditions were

extremely unfavourable for an experiment such as here recorded. The conclusions arrived at are therefore only tentative, and concern more particularly an unusually dry season. The second application of manures, which was to have been made in early January, was held over until the autumn rains and applied during the first week in March. The autumn growth was remarkable, and the recovery in milk-production was soon followed by a quick drop, so that the butterfat returns did not show any increase in favour of any particular treatment during this period. From 9th February till 8th March 1 ton of linseed nuts was fed to the herd, each cow receiving a little over 1 lb. at each milking. The cost of the concentrate was £14.

POINTS FROM THE MANURING AND GRAZING EXPERIENCE.

Points of interest may be summarized as follows :—

(1) Sulphate of ammonia during the warmer part of the spring and early summer—hence the quickest-growing time of the year—will give a response in from two to three weeks after application to rye-grass pasture. The June-July applications will take longer to produce a 4- or 5-in. flush, and indications point to five or six weeks.

(2) During the droughty season of 1927–28 the ammonia apparently gave a response lasting some six to eight weeks. This will doubtless vary under different conditions. Only 85 lb. of sulphate of ammonia per acre was applied at each dressing. Further research will determine what amount of this and other nitrogenous manures should be applied to grassland.

(3) If a field is allowed from twelve to fourteen days' spell to recover, the spring application of sulphate of ammonia should give three or four grazings, or perhaps more.

(4) A stocking of five to six cows per acre is not enough to control strongly growing rye-grass in two days' grazing. Indications are that some twelve to eighteen cows per acre are required to give control and consumption of the " bloom " of the pasture in this length of time.

(5) Three and four days' grazing on the one field is considered too much. Fouling of the pasture is apparently enough in this short time to depress the milk-yield. A maximum of two days should be aimed at during the flush months.

(6) Under drought conditions sulphate of ammonia may adversely affect the autumn clover-growth.

(7) If (6) is correct, spring applications of phosphate (and perhaps potash) appear necessary to strengthen the clover-production. This point is also being investigated at the present time.

(8) Given controlled fields supplying two days' grazing, at least eight fields are required in order to allow a full recovery period to produce a 4- or 5-in. grass flush. These eight fields would appear to be a minimum figure, and the safer number would be ten fields. For example, fifty cows would require ten grazing fields of 2½ to 3 acres, or a total of 25 to 30 acres. These will supply the herd's requirements from mid-October to mid-December. The remainder of the farm should be closed for ensilage and hay.

(9) Where purely grassland farming is being practised, the herd's requirements should be at least 1 ton of ensilage per cow for the autumn

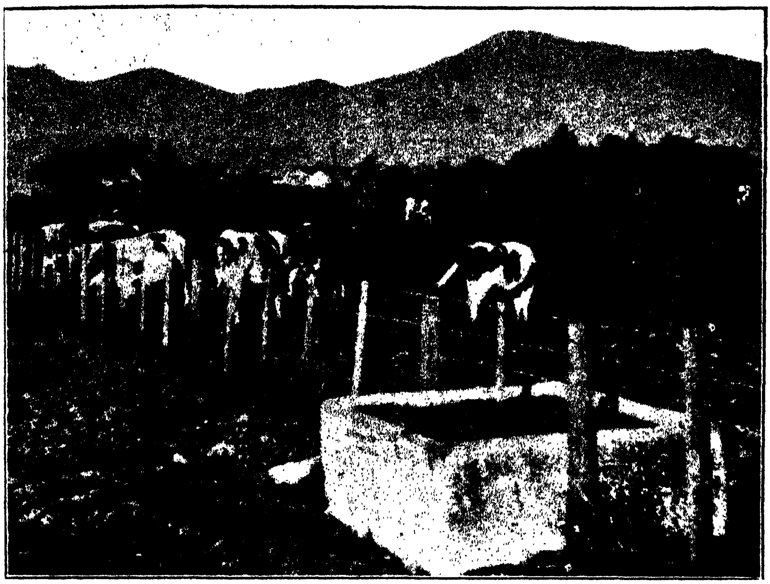


FIG. 2. PORTION OF MR. WARD'S FARM AND HERD (DRY STOCK).
The Manawaru cheese-factory is seen in distance.

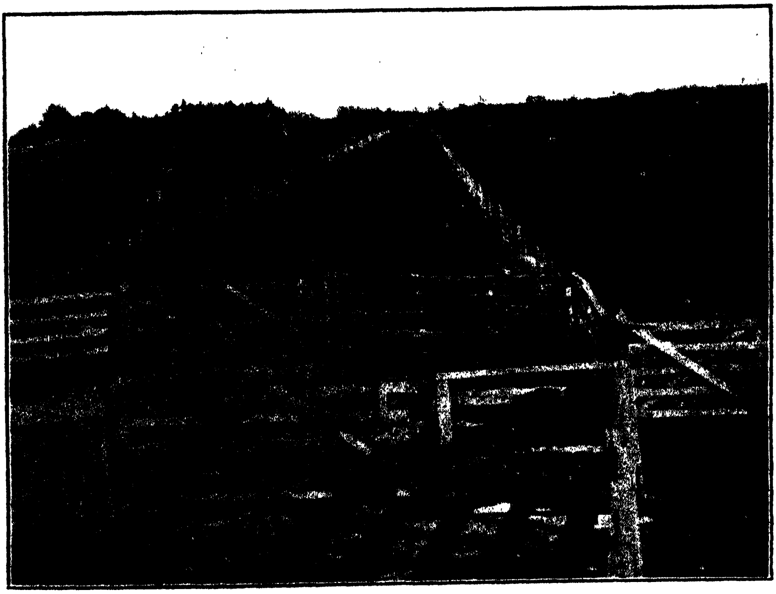


FIG. 3. SHOWING CENTRAL RACE ON THE FARM, TOGETHER WITH SUB-DIVISIONS, WATER-TROUGHS, ETC.
Photos taken in August.

months, 1½ tons of ensilage per cow for the winter and spring, and ½ ton of hay per cow for the latter period. The total of 2½ tons of ensilage per cow and ½ ton of hay can be harvested from ⅜ to ½ acre of intensively treated grassland. This is from one cut only, for it cannot be said to be wise to rely on two cuts of grass each year.

(10) Where a heavier stocking than the above is to be attempted, lucerne must play an important part in supplying the requirements of ensilage and hay. Where lucerne cannot be depended upon, annual crops that will occupy the land for a minimum of time and produce a heavy crop should be resorted to for amplifying the requirements of ensilage and hay.

INCREASE IN PRODUCTION FROM INTENSIVE MANAGEMENT.

Despite the unfavourable season, a very creditable increase in butterfat-production from Mr. Ward's herd was shown. The two seasons are compared in the following table:—

Season.	Acreage.	Number of Fields.	Number of Cows.	Butterfat till December.	Butterfat till May.	Butterfat per Acre.
				lb.	lb.	lb.
1926–27..	50	8	27	4,111	8,043	161
1927–28..	50	10	32	5,865	10,173	203½
Increase in 1927-28	..	2	5	1,754	2,130	42½

The graph on opposite page shows the butterfat production for the last three seasons.

The full benefit from the fertilizers was not obtained during the season of the experiment. Under such dry conditions as experienced, fertilizers are largely inactive. The increase in butterfat was largely due to the better control of the pastures and the consumption of the grass at the 4- or 5-in. stage. A succession of such flushes was obtained with little waste due to grass run to seed. During November most pastures are bolting to seed, and this coincides with the downward trend in production. The spring applications of nitrogenous fertilizers should be made some two or three weeks before the peak of production is reached. As this peak is usually the end of October, and as at this time the grasses are tending to come into seed-head, the applications should in most cases be made about the middle of October.

It is vital, of course, that control should be exercised at this period. If there is a general tendency for most fields to run to seed, either the mower must be used immediately or else one or two fields should be closed for a quick crop of ensilage. This should be cut as early as possible, in November for preference, so that the pasture is not " bled " to any extent and the aftermath comes away quickly and is ready in December. The mower should be set fairly low for trimming off excess growth of pasture. When it is set at 3 in. to 4 in. the grass tends to reseed quickly. October and November are therefore very vital months in grassland farming. The larger fields should be closed for ensilage, &c., thus ensuring the smaller fields for grazing. Better control can, of course, be exercised on these fields, as a heavier per-acre stocking can be brought to bear upon them.

In the experiment the total cost of manures used as extra to the standard 3 cwt. dressing of superphosphate amounted to £50. The extra amount of butterfat produced—2,130 lb.—was worth, at 1s. 6d. per pound, £159 15s. Actually the factory paid out 1s. 8d. per pound on cheesemaking.

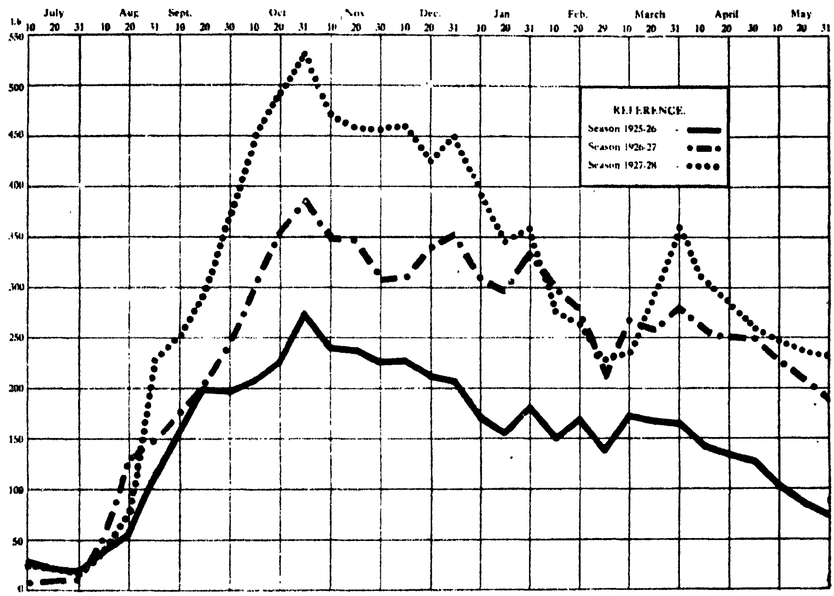


FIG. 4. GRAPH SHOWING BUTTERFAT PRODUCTION OF MR. WARD'S HERD FOR THREE SEASONS.

WINTER APPLICATION OF NITROGENOUS FERTILIZERS.

It is stated in the foregoing summarized points that observations indicate some six or eight weeks as necessary to produce a 4 in. or 5 in. flush of pasture during the winter months. Such a growth will be sufficient in those cases where a large proportion of the farm is being treated, and where there are plenty of fields for rotational grazing. In cases where only one or two fields are shut up to produce early spring feed, a flush of grass 6 in. to 8 in. long will be sought. Such a growth will give a feeding of ten days to two weeks or more, according to how it is fed off. It will take longer, of course, to produce such a growth, and the nitrogenous manures should be applied from mid-May to early June. Something like ten to twelve weeks' growth is necessary to produce this bulk of grass, and a farmer will top-dress according to his calving-dates. The growth should not exceed this, otherwise the tops will tend to yellow off, and the base also becomes matted and turns yellow. An efficient tripod and chain harrowing should follow the dairy herd in the spring.

GENERAL.

At the time of writing (November) Mr. Ward's farm is stocked with forty milking cows, six yearlings, two bulls, and two horses. Ten purely grazing fields each of 3 acres in extent are being used for the dairy herd; the remainder, 19 acres, is closed for ensilage and hay.

The writer acknowledges Mr. Ward's valued co-operation throughout the year, and the courtesy of Mr. G. Graham, manager of the Manawaru cheese factory, in supplying figures of milk-tests.

During the current season a large number of pasture top-dressing trials are being conducted throughout New Zealand, using nitrogenous fertilizers. In each case the experiment has been designed so as to obtain the number of grazing-days each treatment will give, its recovery period, and the per-acre production. Several kinds of nitrogenous fertilizers are also being tested.

NOTE.—Since the writing of this article, Mr. Wild has been transferred, as Instructor in Agriculture, to Invercargill.—EDITOR.

HYDATID DISEASE: ITS CAUSE AND PREVENTION.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

THE mortality rate in human beings and the economic loss from hydatid infestation of animals in New Zealand are still too high, and it therefore behoves the dog-owners of this country to attempt to reduce the parasitic infestation if not to eradicate it entirely. With consistent efforts hydatids *could* in time be eradicated if every dog-owner carried out the necessary methods carefully and thoroughly.

WHAT HYDATIDS ARE.

Hydatids are cysts—hollow, thin-walled bags containing a fluid. There are several varieties, but only one affecting man. In this, *Echinococcus polymorphus*, there are minute heads called "seed-heads," or scolices, attached all over the inner wall of the cyst, and bathed by its fluid. Each hydatid cyst as it grows encounters resistance from the body of its host, and so nature usually produces a fibrous capsule round the cyst which helps to wall it off from the host. Nevertheless in some species of animal they grow excessively, man being the host in which most damage is done by the parasitic cyst. The usual habitation is in the liver or lungs, though occasionally other organs are invaded. As the cyst becomes older it may develop small cysts inside the larger (referred to as "daughter" cysts inside a "mother" cyst), or may develop branches of the one cavity from a slight rupture of the fibrous wall, allowing a hernia of the cyst to occur. This form is most common in sheep and cattle livers, while the daughter cyst is more common in man.

LIFE-HISTORY OF HYDATIDS.

The life-history is well known, and has several times been followed at Wallaceville for experimental purposes. When man is the host there is a tendency for the parasite to kill that host, but in the case of sheep, pigs, and cattle the host is rarely killed by hydatid disease—possibly because of the comparatively short life of a food animal. It is the livers and lungs of sheep or cattle that are dangerous, as regards dissemination of the disease, when fed to dogs without previous cooking. Then the raw hydatid cysts, after being swallowed by the dog, set free in the stomach of the animal all the seed-heads. Each one of these seed-heads now becomes a tapeworm, *Taenia echinococcus*, which by means of suckers and hooks attaches itself to the wall of the intestines and commences to grow. Small segments sprout off from the head, and altogether when adult the tapeworm has four or five. Its total length when well stretched out is rarely more than ½ in.

When the segments mature they are filled with fertile eggs, and the end segment as it ripens is able to detach itself from the parent tapeworm and pass out on to the ground in the fæces of the dog. Such segments appear within four weeks of the time the dogs eat the liver. The segment as it weathers on the ground breaks up and liberates many eggs—between one hundred and two hundred—which have already six small hooks inside ready for attaching themselves when they lose the shell and become larvæ. An herbivorous or omnivorous animal now swallows an egg, sheep and cattle picking them up in the pastures. The egg-shell is dissolved in the stomach of the new host, and the larva bores its way through the wall of the intestine, either into a blood-vessel or possibly directly into the liver or lungs. The liver is the main seat of invasion, but in many cases the lungs are also found infested Here the cysts grow, and the life-cycle is complete.

THE DISEASE IN MAN.

A number of surgical operations are performed annually in New Zealand because of this hydatid cyst which has grown from the egg of the tapeworm of the dog. It is considered that the parasite is usually picked up by young children, and that for many years—until the age of about twenty—there is but slow growth. Occasionally it is noted in early childhood, but usually the diagnosis is delayed, often until well on in life. For the first twenty years of the life of the host the cyst usually remains as a single bladder of varying size. After that time, however, it frequently develops daughter cysts, which in turn carry more seed-heads. By enlargement and pressure the cyst may burst, and so spread daughter cysts all over the abdominal or thoracic cavities.

In these days diagnosis is not difficult, and unfortunately a positive diagnosis means surgical interference in man, the operation being a serious one, more particularly where daughter cysts or adhesions of a large leaking cyst to the wall of the chest or abdomen have occurred, and there is a 10 to 20 per cent. mortality rate. In the laboratory museum at Wallaceville is a cyst taken from the lungs of a boy of three years of age. In this case the boy had caressed, as children do, a

sheepdog which was kept about the place for a month or two, and he contracted the parasite at the age of two. It does not seem usual for many of the parasites to gain a footing in any one human host, and usually no more than one cyst will grow, though possibly others are killed by the body before they are able to develop.

INFESTATION OF FARM-ANIMALS.

Sheep, pigs, and cattle—in that order—are the usual hosts, though horses, rabbits, deer, &c., may suffer to a slight extent. Only very rarely indeed does the infestation kill sheep and cattle. Cases have been seen where pigs have eaten fæces of dogs which were kept in the pigyard, and where the lungs and livers of the pigs were a mass of minute cysts, but such massive infestation is not usual.

PREVENTION OF THE DISEASE.

It must be clearly realized that human infestation cannot take place from eating the flesh of sheep, cattle, or pigs which have harboured hydatid cysts in their organs. It is the eggs produced in the dog or other animal which has swallowed the uncooked hydatid cyst, which when they gain entrance into the human subject, or into cattle, sheep, &c., are responsible for the production of hydatid cysts. As the disease causes loss of human life and is a source of economic loss to the country, it is necessary to prevent it.

At the present time in New Zealand very few town-dwellers become affected, the disease being one which affects country residents mainly. This is because of the system of meat-inspection in force, both for home consumption and for export. Town meat in the larger centres is all inspected by trained men at the abattoirs, and no affected livers or lungs are allowed to leave such abattoirs or freezing-works to be sold. Therefore town dogs must live on meat free from infestation by hydatid cysts, and are unable to get the opportunity of becoming infested with tapeworms. Consequently town children are comparatively safe. In the country, however, sheep are often killed for dog-food, or the dogs are given the raw livers from the sheep killed for human consumption and in which hydatid cysts may be present. In other cases dogs may be allowed to roam and tear to pieces a recently dead sheep. Is it any wonder that country children become victims?

The habits of the dog are most objectionable, as defæcation may take place in close proximity to vegetables of the salad class. Again, the dog in his efforts for cleanliness may frequently lick the hair about his hindquarters, and it is possible for the shed segment of the tapeworm to have become attached to the hair and thus be taken into the mouth of the dog, and later by caress passed on to a child, where it becomes a menace of extreme gravity. Also, in country districts the water-troughs or springs supplying the house are sometimes left open, and what more natural than that a dog should swim in this water and so liberate the segments to infect human beings or stock? This is not the dog's fault, but the negligence of the owner of the dog.

In order to prevent occurrence of the disease serious attention should be given to the following points: (1) Treat all country dogs medicinally at regular intervals; (2) do not give uncooked livers

or lungs to dogs; (3) train children not to caress animals; (4) do not allow dogs to eat unknown carcasses—these should always be buried; (5) keep drovers' dogs under control at abattoirs or meat-freezing works.

MEDICINAL TREATMENT OF DOGS.

In giving medicine to a dog it is advisable when possible to use a material which the dog will take easily and which is not too nauseating. Moreover, it is necessary to starve the dog by way of preparation for the proposed dose. Therefore the animal should be kept without food for twenty-four hours before administering the dose.

The best medicines for tapeworms are as follows:—

(1) Arecoline hydrobromide in a dose of $\frac{1}{8}$ to $\frac{1}{2}$ grain, depending on the size of the dog; a terrier $\frac{1}{8}$ grain; a big sheepdog $\frac{1}{2}$ grain; and a cocker spaniel, say, $\frac{1}{4}$ grain. The pellet or powder is dissolved in about a dessert-spoonful of water. Puppies of the more robust breeds withstand dosing with this drug well, but care must be taken with the toy breeds, which from the nature of their upbringing should not require dosing. This drug only expels and does not kill tapeworms; therefore care must be taken to see that the fæces expelled are rendered harmless.

(2) Liquid extract of male fern, in doses of 15 minims to 1 dram, depending on the size of the dog, following starving and purging. The dog should be prepared by giving a dose of castor-oil, and the day following the action of the drug the animal should be again purged in order to expel all the dead tapeworms. At Wallaceville an effective method was found to be that of purging the animal (the day after dosing with male fern) with $\frac{1}{8}$ to $\frac{1}{2}$ grain of arecoline hydrobromide dissolved in a dessert-spoonful of water.

(3) Areca nut is often used in doses of 10 grains to 1 dram. Areca nut contains arecoline as the active principle, and is not quite so reliable as the pure drug. Arecoline is usually 100 per cent. efficient, but areca nut is much less so.

There are other drugs which may be used, such as kamala, but, as mentioned before, arecoline hydrobromide is the only one that can be relied upon as thoroughly effective against tapeworms. One treatment should be sufficient, but a second a fortnight later would expel any further tapeworms which had entered about the time of dosing and had not been acted upon.

TEMPERATURE OF WAX FOR COATING CHEESE.

MR. J. Murray, Palmerston North, whose work in dairy technique is well known, informs the Director of the Dairy Division that after carefully conducted experiments he has found that a temperature round about 300° F. gives the best results for the paraffin-waxing of cheese. He states in the course of his communication: "When cheeses are immersed in wax at a temperature of 295° to 305° F., the wax becomes an integral part of the cheese, will offer greater resistance to rough handling, and the minimum amount of wax will be used. Cheese waxed at lower temperatures, although having apparently a satisfactory-looking finish, will show a rupture of the wax following pressure of the thumb into the rind. This is more noticeable at a waxing temperature of 240° F. or less, but improves as the temperature is raised."

PASTURE TOP-DRESSING BY MOTOR-LORRY.

DEMONSTRATION AT RUAKURA STATE FARM.

H. MUNRO, Manager, Ruakura Farm of Instruction, Hamilton.

A NEW system of applying artificial fertilizers to pasture which promises to prove effective and very expeditious—at least on level and easy undulating country—has been evolved by Mr. Ambrose Howell, of Rototuna, Waikato, and was recently demonstrated at Ruakura. Under this system a 1-ton motor-lorry is used for carrying the fertilizer as well as for mounting and driving the distributor. A star-feed distributor-box is suspended by iron brackets beneath the lorry, the front of the box being distant about 4 in. from the back wheels. The fertilizer is fed to the distributor through an opening in the floor of the truck. Power for working the distributor is provided by a chain drive working off a cog, which is permanently attached to the left back wheel of the lorry, as shown in Fig. 2.

Fig. 1 shows the original plant. Under this method the distributor, which was the box from an ordinary horse-drawn machine, was suspended behind the lorry, with a direct drive from an eight-tooth cog on the lorry-wheel to a twenty-tooth cog on the distributor. The minimum quantity of fertilizer that could be applied by this drive was 2 cwt. per acre.

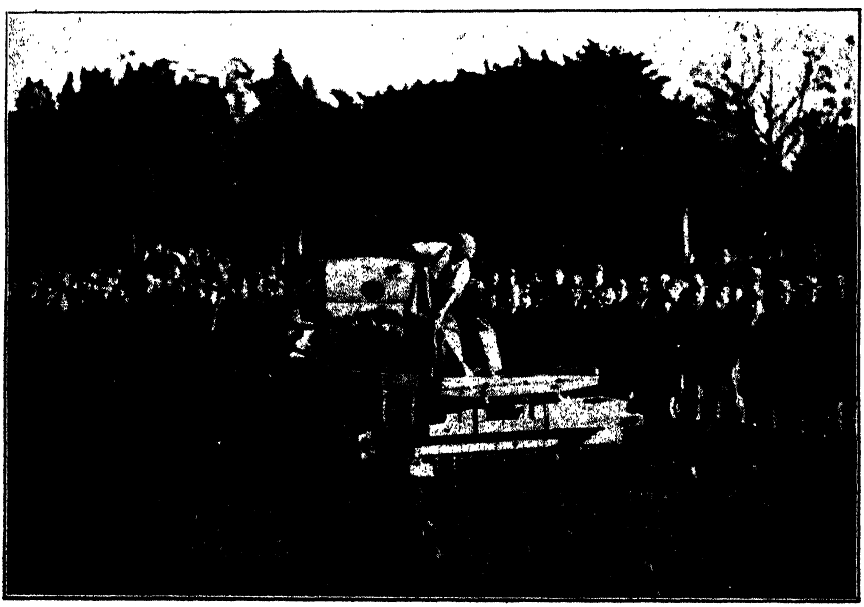


FIG. 1. DEMONSTRATION OF THE HOWELL FERTILIZER DISTRIBUTING SYSTEM (ORIGINAL ATTACHMENT) AT RUAKURA FARM OF INSTRUCTION.

On this occasion an 18-acre paddock was top dressed easily in 1½ hours, at rate of 2¼ cwt. per acre.

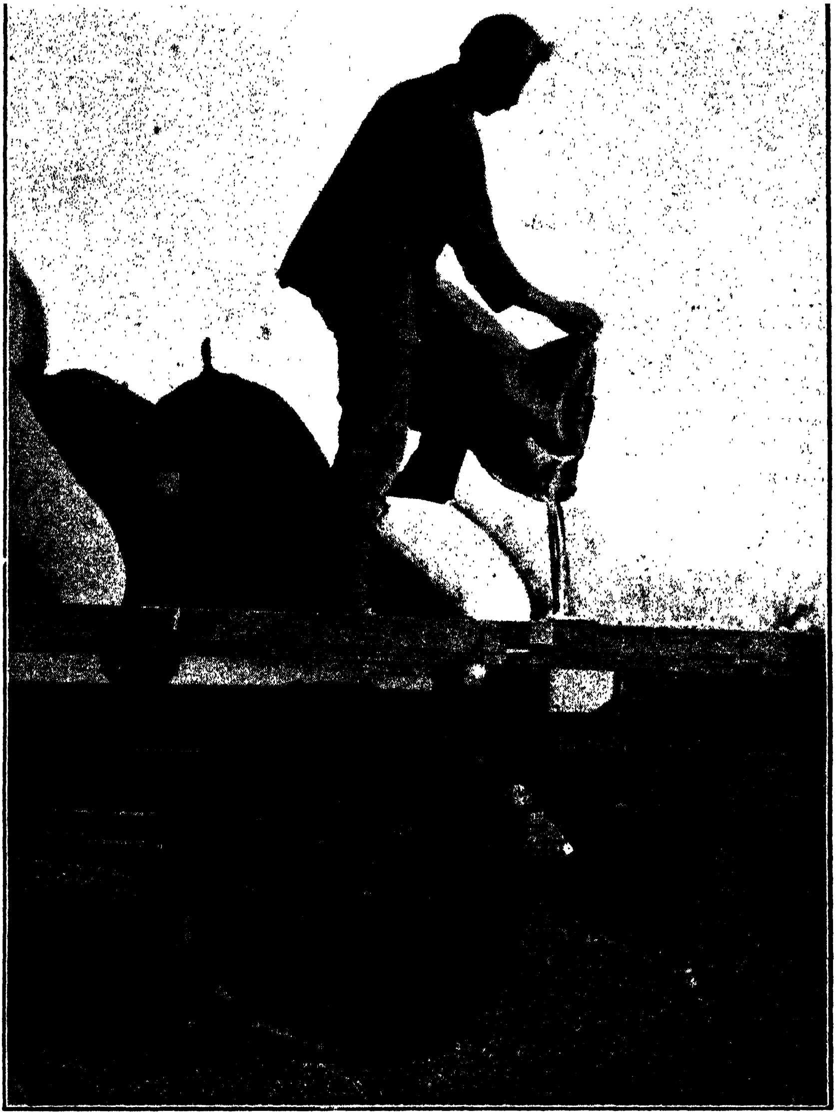


FIG. 2. THE LATER TYPE, WITH IMPROVED DISTRIBUTING EQUIPMENT.

In the improved plant (Fig. 2) as now in use a specially constructed distributor is suspended beneath the truck, and provided with a drive which gives a much greater range of distribution, permitting dressings of fertilizer ranging from 1 cwt. to 30 cwt. per acre.

The area that can be top-dressed in any given time depends largely on conditions, such as size of the field and contour of the country. On

level country with a good surface the maximum area that can be effectively treated is approximately 15 acres per hour, and at least 8 acres per hour can be treated on any country on which the plant can be safely used.

It might at first appear that the speed at which the lorry travels would cause the stars within the distributor to revolve so rapidly as to cause damage, but actually they do not revolve more rapidly than when horse-drawn, the larger cog wheel fitted to the driving-shaft of the distributor compensating for the greater speed.

THE PRODUCTION AND GRADING OF CREAM.

PRACTICE ON FARM AND AT DAIRY FACTORY.

W. DEMPSTER, Dairy Instructor, Hamilton.

COMPULSORY grading of cream in New Zealand has operated only since November, 1926, and probably no measure for improvement in the quality of our dairy-produce has established a uniform standard so quickly. This is largely due to the method adopted in the examination of applicants for cream-graders' certificates. The applicant can nearly be said to examine himself. A certain number of cans of varying qualities of cream are graded by the examining officer. The candidate is then asked to grade and classify the same material, after which the cans are changed, and he is asked to regrade them. If he agrees with himself on both rounds, although he may differ to a slight degree from the examining officer, it is a simple matter to teach the true value of flavour. On the other hand, if the candidate does not agree with himself on his second trial, it is shown at once that he is not capable of detecting the different flavours, and no amount of tuition would make him an efficient grader. The majority of graders have taken a keen interest in their work and have done the grading efficiently, realizing that their livelihood depends on the faithful interpretation of the regulations. It is very pleasing, when visiting a cream-grading platform, to see the keenness of the graders, as is shown when their attention is drawn to a flavour in cream with which they are not familiar. For the assurance of farmers who may think their grade has been lowered without cause, it may be stated that a doubtful cream is rarely lowered without the introduction of a second opinion.

While probably 95 per cent. of our dairy-farmers have accepted cream-grading and realized its advantages, there remain about 5 per cent. of dissentients, who can be divided into two classes. The first class claim that cream cannot be graded; the others say they know cream and are not getting their correct grade, the chief cause of complaint very often being that the neighbour is receiving a higher grade. The first class of supplier would stop the industry from progressing, as such a man is loath to attribute to others faculties which he himself does not possess. The senses of sight, smell, and taste may be quite defective when applied to cream-grading, much in the same way as

many people lack an ear for music. The man who says he has been among cows all his life and therefore knows milk and cream, really means that he knows milk and cream according to his own palate. He can invariably distinguish flavours, and thus provides a direct negative to the first class of dissentients. But while he can distinguish flavours he is not capable of giving them their true value, as probably he has not had the opportunity of making comparisons, and therefore does not know the butter-buyer's requirements. The butter-buyer is the man who must be pleased. The grading of cream, butter, and cheese is done with the object of giving him what suits the market.

The buying of butter is done on the senses of sight, smell, and taste. The grading of cream must also be done by the same senses. It is obvious that it would be a waste of time to apply a scientific test to a sample of cream which did not look, smell, and taste good. No farmer can therefore say that he would get a higher grade for such cream were a scientific test used. It can be taken for granted that some would get a lower grade, as a scientific test would show defects in cream in the course of development, defects which had not reached the stage where they could be detected by the senses.

GRADING OF CREAM IN RELATION TO THE GRADING OF BUTTER.

Controversy has sometimes arisen after the publication of dairy-factory balance-sheets to the effect that the percentages of the different grades of cream do not correspond with the different grades of butter at the grading-stores. Where a factory is well equipped and managed and is drawing its supply of cream from one class of country—either hilly or flat—and no butter is sold locally, the whole output being graded for export, it will be found that the grades of cream and butter correspond within a reasonable margin. On the other hand, where a factory is drawing its supply of cream from two classes of country—both flat and hilly—there may be a wide discrepancy in the percentages of grades of cream taken in relation to the grades of butter. In Auckland Province it is generally noticed that on flat, heavy country rye-grass, cocksfoot, white clover, and (in the north) paspalum are the main constituents of the pasture, and these grasses give a high-quality cream, which if pointed would score 94 points or over. But on adjacent hilly or undulating country, which until the advent of general top-dressing gave us our best cream, the pastures have been so changed that trefoil, Lotus major, subterranean clover, and cow-grass are now commonly dominant, and the quality of the cream (more especially in localities where there is much sweet vernal) will be on the border-line between "first" and "finest" grade.

It will readily be seen that the high-quality cream from the flat country when mixed will carry the border-line and a proportion of first-grade creams upwards, and will show a higher percentage of "finest" butter. Yet the grading of the cream would be consistent, as were the first-grade cream manufactured by themselves the result would not be finest butter. Where the greatest proportion of cream is first, and the finest is only on the border-line, the slightest error in manufacture would result in a proportion of the finest being carried downward; while, had the finest been churned by itself, the resultant butter would have been finest.

During the winter months this is very apparent, as, while there is a small percentage of finest cream, there is very little finest butter manufactured. As the supply of winter cream is increasing yearly, there should soon be a surplus of winter butter available for export; and in the writer's opinion the supply of winter cream to-day is not much inferior to the bulk of the summer supply ten or twelve years ago. As the great majority of farmers have responded in the past few years to the call for improved summer supply, so will they respond in respect to the winter season. Furthermore, as the winter supply of cream increases there will be more frequent deliveries.

HANDLING CREAM ON THE FARM.

The methods of handling cream at dairy factories in New Zealand compare more than favourably with those of other countries, but our weakness lies in handling milk and cream on the farm. It may be said that only about 15 per cent. of our farmers do everything that is known to be necessary to forward cream in as good a condition as is the milk when received from the cow, and which should result in a cream scoring 94 points or over. At the other end of the scale there may be about 10 per cent. who should not be handling cows at all, as these men, even when shown by a farm dairy instructor that it is possible for them to get a higher grade, soon drift back to their old methods.

There are some 65 per cent. of farmers delivering finest-grade cream around 93 points which can best be described as a borderline cream, while another 10 per cent. deliver a cream between 90 and 92 points. It is from this great bulk, which equals perhaps 75 per cent. of our output, that most of the improvement in the future may be expected. Probably 80 to 90 per cent. of this cream could be improved one point; furthermore, the farmers would be willing to effect such improvement if they only realized that it was possible and necessary. If we are going to hold our high position in the world markets this improvement must be effected. It is often noticeable on a farm from which finest grade—probably a 93-point—cream is being produced that one or two small things are neglected, and it is these small things which make the difference between a 93- and a 94-point cream or milk. One point in grade may seem insignificant to the individual, but taken on the aggregate of 90 per cent. of our farmers this one point would place our dairy-produce in an unassailable position. While this article refers primarily to cream, the foregoing paragraphs apply similarly to the production of milk for cheesemaking.

Where actual points for cream-grading have been given, the graders in many instances have awarded only 93 points as the maximum. The spirit of emulation has thus not been encouraged as much as it might have been, and much good could be done were points over 93 awarded to the deserving suppliers. The points awarded in connection with cream-grading are equivalent to the points which the resultant butter would score at the grading-stores if such cream were churned without mixing with other grades. Dairy companies should always send the supplier a docket informing him of the grade, or the grade and the points, awarded to each lot of cream received from him.

FARM DAIRY INSTRUCTION COMBINED WITH CREAM-GRADING.

While engendering the spirit of emulation may lead to appreciable improvement in the quality of the cream, it is necessary that cream-grading and farm dairy instruction be carried on conjointly. The continuous receipt of low-grade scores, without any assistance or advice toward improvement, tends to a spirit of indifference and hostility. This, in many instances, would be removed by a visit from a farm dairy instructor. When farm dairy instruction was inaugurated and no cream-grading was done the results were disappointing, for until cream-grading was introduced the farmer did not realize the necessity for improvement, and was inclined to look upon the farm dairy instructor as an interloper. Since the introduction of cream-grading, however, the instructor receives a cordial welcome to practically every farm. Dairy-farmers generally recognize the value of instruction, and have ceased to think that low-grade cream comes only from farms other than their own.

Systematic visits are made to the farms by the instructors for the purpose of giving instruction in the best methods of handling milk and cream, the working of milking-machines and separators, the proper and quickest methods of keeping dairy premises and appliances clean, and generally carrying out in a most efficient manner the regular work connected with a dairy. The instruction given in the proper running of a separator almost in itself justified the employment of farm dairy instructors. Such instruction without cream-grading did not give the best results, nor can cream-grading exercise its full benefit without farm dairy instruction. Continual low grading of cream may spur some farmers to better efforts, but others may become disheartened or callous. Service such as the farm dairy instructor can give is helpful to both types.

CHANGES OF FEED AND PASTURES.

Since the inception of cream-grading it has been brought very prominently to the notice of farmers that a change in feed often brings a change in grade, for everything a cow eats must affect the quality of the cream. Even the best of grasses, legumes, or roots if fed exclusively for an extended period, will more or less affect the health of the cow, and in turn affect the quality of the cream. This is very noticeable in the spring, as during the winter months the cows are usually fed liberally on hay, with probably a dearth of roots or green feed. Such cows are more or less in a state of impaction, and when they are turned into paddocks which have been shut up in order to get an early growth, the change from practically a dry feed is so sudden that they commence scouring. Consequently the resultant milk and cream is so strong in flavour that it cannot be classed as finest.

As already indicated, rye-grass, cocksfoot, paspalum, timothy, and white clover produce the best-flavoured cream, the resultant butter being classed as the finest. Cow-grass, subterranean clover, trefoil, Lotus major, and lucerne produce a cream with a distinctive flavour, which cannot be classed as finest, for while the resultant butter may

bring as high a price as finest on special markets it could not be sold as finest on any or every market in the world. Mangolds, kale, chou moellier, rape, soft turnips, swedes, green oats, and barley, if fed in excess, often produce redwater in cows; and even in herds where the malady is not apparent so many of the cows are affected without showing acute symptoms that the cream is nearly always second grade.

How much this second-grade cream is due to feed, and how much to the health of the cow, is hard to determine. Probably 10 per cent. of swedes, 12 to 15 per cent. of soft turnips, rape, chou moellier or kale, and 20 per cent. of mangolds could be used as supplementary feed directly after milking without affecting the quality to any marked degree. The writer's attention was recently drawn to some cans of cream which were only passable as second grade. On visiting the farm it was found that the cause of the trouble was that the cows for two days had gorged themselves on partly cured mangolds to such an extent that many of them could not stand up. A cow has been known to eat 60 lb. of soft turnips in thirty minutes. When cows are turned into a turnip paddock twenty to twenty-five minutes is sufficient, as in that time they will get as much roots as is good for them and will dirty less. The important point when changing from winter to spring feeding is to make the change gradually, as much of the first-grade cream would be made finest could the cows in the spring be induced to eat hay after the grass becomes sweet and succulent. A certain amount of success has been achieved along this line by sprinkling the hay with molasses and water.

DEVELOPMENT OF FEED FLAVOURS THROUGH CONTAMINATION.

While it is pretty well recognized that feed flavours as such will not develop in butter, and can be described as characteristic flavours, feed flavours that arise through contamination are a different matter, as they are of bacterial origin and will develop in butter; consequently a dirty milking-machine can create feed flavour, which, had the milking-machine and utensils been clean, would not have lowered the grade of the resultant butter. Experiments have isolated the bacterium which causes turnip flavour independently of the purely feed flavour. This organism is also found in the manure of the cow, even after the manure is dry, and therefore explains what was previously a puzzle, as often a farmer's cream had turnip flavour at a season of the year when turnips were not available. It is evident that particles of dust containing the bacteria were sucked into the teat-cups when they were being placed in position on the cow's teats, and, becoming moistened with the milk, set up bacterial action and so developed the turnip-flavour. Furthermore, it is pointed out that manure from turnip-fed cows can smell so strongly in humid weather as to taint cream held in close proximity. There are therefore at least these two sources capable of developing turnip flavour when no turnips are being fed.

CLEAN SURROUNDINGS ESSENTIAL.

Many suppliers are going to a great deal of trouble to get finest-grade cream, but because of the lay-out of the shed it is almost impossible to do so, as the air around the shed and separator-room is not pure. Cream when leaving the separator is at just the right temperature to

take a taint, and if the atmosphere is impure the cream is certain to pick up whatever smell there is. The cream will smell just as does the separator-room or the place where the cream is kept. When in trouble the dairy-farmer might invite some one unaccustomed to milking to pay the dairy a visit. The visitor will probably detect a smell with which daily contact has made the owner familiar. One frequently hears complaints from farmers that their cream was graded low when not sour, sour cream being in their opinion the worst of all. But it is natural for cream to go sour; non-souring is a sure sign of inferiority. It is difficult to get two cans of cream exactly alike in flavour. So well versed do graders become that they can remember flavours as easily as they can remember the cans. The flavour is just as distinctly impressed on the grader's mind as if he had seen it.

POINTS IN THE PRODUCTION OF GOOD CREAM.

The following points are essential in practice if the farmer is to deliver a good product. If he is neglecting any of these essentials he cannot be said to be doing his best, and has no cause for complaint if his cream is graded other than finest.

(1) Every part of the milking-machine, vacuum-pipes, and tank, separator, &c., must be kept clean.

(2) The releaser-bucket and separator must not be in the engine-room. A passage between the separator and the engine-room is necessary.

(3) Milk should be separated and cream kept in a well-ventilated room, and the cream stirred often with a tinned metal plunger.

(4) The cream should be cooled with a water-cooler. Putting the cream in a tub of water is not sufficient.

(5) The surroundings of the separator-room and place where cream is kept should not be muddy.

(6) A plentiful supply of boiling water is necessary. *Hot* water should not be mistaken for *boiling*. Boiling water if carried from the house is useless for making the machine sterile.

There are many backblock settlers carrying out these essentials with good results, while often other farmers are complaining of the inability to produce a finest cream, giving as reasons the difficulties which have been overcome by others.

CAUSES OF SECOND-GRADE CREAM.

The following are some causes of second-grade cream, and in most cases they can be remedied by the famer.

(1) Badly arranged shed; (2) neglecting to cool cream; (3) mixing hot and cold cream together; (4) engine and separator being in same room; (5) failure to clean vacuum-pipes and vacuum-tank, and to leave vacuum-tank open when not in use; (6) dirty rubbers and milk-pipes; (7) putting rubbers in stagnant water; (8) lack of ventilation in separator-room; (9) muddy surroundings near separator-room; (10) not removing lids and not washing and scalding cans immediately on return from factory; (11) use of rusty cans and tinware; (12) using separator-room as storeroom; (13) use of carbolic disinfectants; (14) skimming too thin; (15) neglecting to scald tinware; (16) sour skim-milk barrels; (17) not washing the separator

after each use; (18) keeping cream too long on farm; (19) standing cans in sun awaiting conveyance; (20) using a cloth for a strainer, or using a cloth for washing instead of a brush; (21) using too small a separator; (22) using milk from unhealthy cows, or separating too soon after calving; (23) flushing out separator with hot water after separating; (24) using a teat-salve containing an odorous disinfectant; (25) pungent feed-flavours; (26) milking with soiled hands; (27) milking into unclean buckets.

BAD FLAVOURS AND THEIR CAUSES.

The following are a few flavours in cream easily recognizable, together with their causes:—

(1) Stale: This flavour is caused by keeping cream too long in an unsuitable place; neglecting to cool cream; mixing hot and cold cream together; skimming too thin and not stirring. A small quantity of this cream will flavour a whole vat, and it is always graded second grade.

(2) Maori bug: This is a smell like that which a Maori bug emits when disturbed or crushed. A little of this cream will flavour a whole vat. The flavour may be caused by the separator not being properly washed and scalded, yellowish slime forming on the tinware. Often a cloth more or less impregnated with the same slime is used for a strainer or in place of a scrubbing-brush. The flavour is accentuated by mixing hot and cold cream. Such cream should always be graded second, and in bad cases returned to the supplier.

(3) Fermented: One of the worst flavours. The cream is full of gas-holes, sometimes as large as a shilling. It often works like yeast and overflows the cans. Causes may be putting cream into cans which have previously held cream, and have not been properly cleansed and scalded; neglect to cool cream; mixing hot and cold cream; or keeping cream too long. Such cream is always second grade.

(4) Tallowy: The cream tastes and smells like tallow. The flavour is caused by washing the bowl of the separator with slime in it, then washing tinware in the same water and not scalding afterwards; putting cream into a warm can; or standing cream in sun; contamination from sheep-skins or harness, or various stores in dairy; washing the separator only once daily.

(5) Curdy or cheesy: This is a smell and taste resembling bad cheese. The causes are skimming too thick and not cooling; taking up taints from stores in the dairy, or oil and spilt milk on the separator-stand; bad ventilation; keeping cream too long without stirring.

(6) Sour: The cream tastes sour to a disagreeable extent. The causes are skimming too thin, and not cooling; keeping the cream too long on the farm in a warm atmosphere; the presence of skim-milk barrels in close proximity to where the cream is kept.

(7) Milking-machine: This flavour is caused through not cleaning rubbers, vacuum-pipes, tank, and releaser, or from perished rubbers; or it may be that the exhaust from the vacuum-pump is discharged

too near the milking-shed, so that the discharged air is redrawn into the system when the teat-cups are being put on the cows.

(8) Kerosene and benzine: Flavours caused by having the separator or releaser in the engine-room; kerosene or benzine stored in the dairy; smoky kerosene-lamps; exhaust from engine not being carried to leeward so as to avoid fumes being drawn into system when teat-cups are being placed in position on cows' teats; using benzine-tins as buckets; using roof-water for washing when exhaust is discharging through roof; using water out of the circulating tank for washing purposes.

(9) Carbolic: Flavour caused by using odorous disinfectants in shed, or odorous salve on cows' teats.

(10) Metallic: Flavour caused by cream taking up iron or copper after being put into cans or other tinware, such as milk-vat, separator, &c., with parts devoid of tin and perhaps rusty.

(11) Ropy: The cream lifts in strings. Caused by unhealthy cows, or cows drinking stagnant water.

(12) Rancid: Caused by chemical changes brought about through lack of cleanliness, and high temperatures.

(13) Cowy: Due to using milk too soon after calving; bad drainage in cow-shed; cows in ill health.

(14) Musty: Caused by cream being kept in a wooden building with no ventilation; decaying timber in separator-room.

(15) Slimy: Caused by using too small a separator. The bottom plates become dogged with slime, a certain amount passing into the cream. (Flushing out the bowl with hot water when finishing separating causes slime to pass into the cream; use skim-milk to flush bowl.)

(16) Cow-yard: Caused by muddy surroundings; manure-heaps; bad drainage; smells drawn in through teat-cups; leaving used overalls in dairy where cream is kept.

(17) Buttercup: Flavour prevalent in early spring, and is not unlike radish—sharp and pungent to the nose. Cream generally of high colour.

(18) Watercress: Cream with this flavour smells like acetic acid. More troublesome in the autumn.

(19) Pennyroyal: An easily detected flavour, smelling like the plant.

(20) Turnips, rape, kale, chou moellier: Strong undesirable feed flavours, always causing second grade.

Corticium Disease of Potatoes.—Experiments with corticium disease were carried through the season of 1927–28 by the mycological branch of the Fields Division, with the result that a considerable quantity of tubers free from this disease was secured. In plot experiments appreciable increases in yield were obtained over untreated potatoes. Dry dust treatments on the control of this disease proved under field conditions to be useless, even the best of the treatments having a high percentage of viable sclerotia present when the tubers were lifted.

LUCERNE-GROWING IN MID-CANTERBURY.

SOME EXPERIENCES AT ASHBURTON EXPERIMENTAL FARM.

J. G. McKAY, Farm Manager.

LUCERNE-GROWING is still more or less in the trial stage in Mid-Canterbury, and any marked increase in the area devoted to its growth within the past five or six years has been confined chiefly to the better lands where mixed farming is the practice. So far as the writer can gather, this increase does not exceed a matter of from three hundred to four hundred acres altogether. Demonstration plots at the Ashburton Experimental Farm have furnished useful information which has been available to and much appreciated by intending growers, and it is thought that a brief account of some results and experiences will be of interest.

INFLUENCE OF LUCERNE-GROWING ON CARRYING-CAPACITY.

It may be said that lucerne is no exception to the general rule governing pasture, in that its productiveness is governed by seasonal conditions and the class of land on which it is grown. Without irrigation or good summer rains it does not altogether solve the autumn feed-shortage problem in this district, as its growth at this period in average seasons is comparatively light. Nevertheless, while not entirely obviating the necessity of growing rape or other green feed for autumn, it is capable of carrying more stock and providing earlier spring feed than anything else of a permanent nature here.

During the seasons 1926–27 and 1927–28 the carrying-capacity of lucerne was tested against a similar area of young perennial rye-grass and red and white clover pasture, figures being taken from September to January in each season. The lucerne showed a carrying-capacity equivalent to 3·98 sheep per acre per annum for the period, against 2·93 for grass pasture. The land was of a similar nature in each case, varying from good to medium loam with shingle outcrops. The grazing method was identical in each case, stocking being intermittent throughout the growing-period, with both areas unstocked during the winter. Practically half of the lucerne area used in the trial has been grazed during spring and summer every season since its establishment in 1921.

It may be stated that winter grazing of lucerne has never been practised at Ashburton. If growth is fed down in March the stands are practically dormant during winter, and no good purpose is served by stocking at that stage. The best stands on this farm have shown a carrying-capacity equivalent to 3·2 sheep per acre per annum, with sufficient lucerne hay to bring the figure up to 6·7 sheep if supplemented by winter grazing in grass paddocks, which do not necessarily require to be good pasture-land, but light holding country for feeding-out purposes. Such country may safely be stocked at the rate of ten ewes per acre; and, although our experience in this respect is confined to actual winter months only, there is no evidence that it could not be continued for a longer period without ill effect upon the health of the stock.

A ration of 2½ lb. of lucerne chaff per head per day, with supplementary grazing as described, has been found sufficient to winter breeding-ewes well. A first draft of lambs, representing approximately 45 per cent. of the mob, from ewes wintered in 1924 in this way and depastured thereafter on green lucerne, realized the record price at that time of 46s. per head when three months old. Indications, however, are that as a finisher for forward stores lucerne is slower than good rape.

During 1923 a mob of 300 forward store lambs on account of Messrs. Dailey and Manchester was drafted into two lots of 150 each and topped off on lucerne and rape respectively. Although actual figures are not available, the writer was informed by Mr. Dailey that the number of second-grades was much higher among lambs fattened on lucerne than among those on rape. Though this trial may not be considered sufficiently searching to warrant its being taken as definite under all conditions, the writer is of the opinion that at least for the season mentioned it was quite reliable. There was an evident bloom or finish on rape-fed lambs which was lacking among those on lucerne.

Until the present season—during which two sheep on the farm have so far died from scour—deaths among sheep grazed on lucerne have never been attributed to this cause. Although somewhat laxative when the growth is very young, and short, it soon hardens up if sunshine prevails. In certain seasons, notably in 1925, when rye-grass and clover pasture was rather badly affected with rust, and ewes and lambs grazing thereon were scouring more or less, it was noticed that when moved on to green lucerne scouring ceased immediately. However, the death-rate from other causes, principally blowing or bloat, has always been higher on lucerne than on pasture, and for the seasons 1925–26–27 deaths directly attributable to this cause represent quite 3 per cent. of the sheep grazed. Although the majority of such deaths have occurred following heavy dews overnight or during showery weather, quite a number have been recorded under extremely dry conditions with north-west winds blowing day and night.

RATE OF SOWING.

In sowing certain areas in the seasons from 1917 to 1921 provision was made to compare various rates of sowing, 2½ lb., 5 lb., 18 lb., 15 lb., and 16 lb. per acre being tried. The respective distances apart in the rows were 7 in., 14 in., and 21 in.

If judged by the amount of hay produced, the rate of sowing, within certain limits, appears not to be important. 5 lb. per acre in 21-in. rows will produce as much as will 15 lb.; or 8 lb. in 7-in. rows as much as 16 lb. While 2½ lb. per acre in 7-in. rows is manifestly too thin a seeding, the same rate in 21-in. rows has under dry conditions produced as much as a 15-lb. seeding. This would appear to indicate that there is no gain in seeding up to 15 lb. per acre, even in 7-in. rows. However, even if comparatively thick seedings ultimately mean a survival of the fittest (and no doubt they do), there is plenty of evidence that light seedings encourage the early incoming of grasses to the detriment of the stand.

WIDTH OF ROW.

Except perhaps on hard-pan, where plenty of room for lateral root-growth is necessary, the 21-in. row method of growing lucerne is

not advocated. The chief objections to such a spacing are its unsuitability for haying, the encouragement of grass and weed growth between the rows, and the fact that when grazed in spring and summer, following winter cultivation, dingy wool invariably results, through the introduction of dust and dirt in dry windy weather. Probably its chief virtue from a grazing viewpoint is that, with the extra walking-room provided, stocking may be delayed during early spring until the lucerne hardens up.

The 14-in. row system, while having this grazing advantage to some extent, presents similar difficulties for haying, the crop usually requiring to be cut with the rows, and not round about, as may be done with 7-in. rows or broadcast lucerne.

Average yields of hay over a number of years favour the narrow spacing, showing a distinct drop when the 21-in. rows are reached. Instances are on record of an increase of 2 tons in green weight per acre in favour of 7-in. over 21-in. rows. On lands of free subsoil the 7 in. row is for general purposes undoubtedly the best.

PREPARATION OF SUITABLE SEED-BED.

The importance of a well-consolidated seed-bed cannot be overstressed, especially where the seed is being drilled in. Cases have come under notice here where a seeding of 2½ lb. per acre in 21-in. rows has produced as many plants per yard as a seeding of 15 lb., due entirely to overdeep sowing in the latter case. Investigation has shown that numbers of poor strikes and subsequent thin stands have resulted through sowing the seed too deeply. While the drilling method is advocated for local conditions in preference to broadcasting, owing to the fact that more even strikes are assured if the seed-bed has been properly prepared, it is realized that difficulty is sometimes experienced in getting the top-soil sufficiently consolidated under dry conditions to ensure shallow seeding.

If after the seed-bed has been prepared it is found to be too dry and loose the following method has been found excellent: Roll and leave the ground until rain falls. Allow sufficient time for annual weeds to germinate, then harrow, and when the surface mulch is sufficiently dry to ensure its falling in behind the coulters when drilling is done roll again, and sow, using blunt grain (or preferably turnip) coulters for the work. If the weather has been favourable and these operations rightly timed, sowing to a depth of from ½ in. to 1 in. is quite feasible without suspending the coulters in any way, and with sufficient dry tilth to cover the seed without resort to harrow or roller. The fact is that the object is defeated if either of these implements is used, as anything up to an extra inch of covering may then result. The roller has nothing whatever to recommend it at this stage. It consolidates the top-soil and detrimentally affects early seedling growth.

MANURING, LIMING, AND INOCULATION.

It has been recorded that in establishing certain stands, where lime and super were tested against lime alone, superphosphate gave a 75 per cent. increase in the first year, and even in the third season after

establishment a 7 per cent. increase in its favour was recorded. Thereafter the lime plots were equally good. However, the increase due to the addition of super over the three seasons, and the absence of weed-growth due to the extra cover thus afforded in the first season, leave no doubt as to the value of this fertilizer in establishing lucerne. It is quite evident that lateral root-growth due to its application at time of sowing is purely temporary, and that tap-root growth is not retarded to any appreciable extent by its use. Plants taken from a stand eighteen months old, on one of the best areas of the farm, where super at 2 cwt. per acre had been applied at time of sowing, were quite free from lateral growth, and the taproots were in some cases 5 ft. in length.

The effect on growth and colour from applications of inoculated soil prior to sowing has always been most marked. In the course of establishment stands receiving applications of 3 cwt. per acre without super have produced as much in green weight during their first season as those receiving 2 cwt. super without inoculated soil. An attempt was made in 1917 to establish lucerne on the farm without lime, manure, or inoculated soil, and the result can be regarded as a failure. A similar attempt with lucerne in 21-in. rows was made in 1919, and this stand merely existed until lime and inoculated soil were applied some eighteen months later. Quite good stands have been established where the land has received an application of lime alone, but the quickest returns have been obtained by using lime, manure, and inoculated soil prior to or at time of sowing.

GRAZING AND ITS EFFECT UPON THE STAND.

It would be idle to state that lucerne stands used exclusively for grazing are not detrimentally affected thereby, however careful the management. However, the degree of damage is not greater than one would expect, and in most cases is quite in proportion to the amount of grazing done. Although apparently unaffected for the first three or four seasons, grazed areas have then shown a falling-off in carrying-capacity. Spring growth is slower, and the incoming of grasses and weed grasses is noticeable. Weed grasses, such as barley-grass, goose-grass, and hair-grass, are seldom eaten by stock when better feed is available, and they run to seed in autumn and spread rapidly. Stands hayed in summer and grazed in autumn make more rapid growth in spring, and, generally speaking, are almost entirely free from grasses.

If judged on the wide-row system there seems little in the contention that lucerne should not be grazed until thoroughly established. The damage to stands grazed from their first season onward is apparently no greater than where the practice has been to hay for two and three seasons and then graze. It may be, however, that with the extra root-room and air-space provided the young plant is better able to sustain itself than if sown in narrow rows or broadcast. It has certainly been observed that lucerne in 21-in. rows comes away quicker after cutting and grazing than in 7-in. or 14-in. rows.

Old lucerne stands sown in 1917, although now becoming infested with Poa pratensis, are still producing too much feed to warrant ploughing up. These stands have been used almost entirely for grazing

during the past six seasons. Apart from their value for haying and grazing, they have successfully demonstrated the effectiveness of lucerne in smothering Californian thistle. The land was rather badly infested with the thistles when sown, but none have been observed since the lucerne became established.

TOP-DRESSING.

The response of lucerne to fertilizers used as a top-dressing has always been more marked on narrow than on wide rows, particularly on comparatively young stands. With the extra feeding-ground provided by the wide spacing, the plant at this stage is probably capable of producing something near its maximum without top-dressing. The lasting effect of super as a top-dressing for lucerne is evidenced by the following results. A stand sown in 1921 in 7 in. rows was top-dressed for the first time in 1924. The weights given below represent one cut in each season.

Season 1924.	Green Weight per Acre. Tons.	Increase over Control. Tons.
Control (no manure)	2·98	..
Lime, 840 lb. per acre	3·59	0·61
Super, 2 cwt. per acre	4·15	1·52
Lime, 420 lb., and super, 2 cwt., per acre	4·00	1·20

Season 1925.	Hay Weight per Acre. Tons.	Increase over Control. Tons.
Control	2·19	..
Lime	2·56	0·37
Super	2·52	0·33
Lime and super	2·67	0·48

Season 1926.	Green Weight per Acre. Tons.	Increase over Control. Tons.
Control	4·6	..
Lime	5·6	1·0
Super	7·2	2·6
Lime and super	7·6	3·0

Season 1927.	Green Weight per Acre. Tons.	Increase over Control. Tons.
Control	5·0	..
Lime	5·7	0·7
Super	6·4	1·4
Lime and super	6·3	1·3

As the aftermath in each season has shown marked growth in favour of fertilizers the actual increase can scarcely be estimated. All plots were cultivated and harrowed immediately following the application of lime and super in 1924, and have received similar cultural treatment in each successive winter, which fact makes the lasting effect of the super rather remarkable. It will be noticed that its greatest increase over the control is recorded in the third season after application. The land where the trial was conducted had received 1 ton of burnt lime per acre previous to sowing in 1921.

WINTER FEEDING OF HAY OR CHAFF.

Lucerne hay or chaff is relished by sheep of all breeds and ages. Half-bred station ewes that have never seen hay are no exception, and take to it readily. Although not considered a completely balanced stock-food, good lucerne hay evidently possesses some quality which aids digestion and makes it a valuable winter fodder for sheep, even if feed alone. Where the stocking is heavy during the feeding-out period and the breeding-ewes are relying entirely on hand-feeding, they should be driven about frequently during the last month of pregnancy, otherwise protrusion of the vagina will result through lack of exercise. If left to themselves they soon cultivate the habit of lying about waiting for the ration of hay or chaff to be brought along. When given sufficient exercise, the death-rate among the sheep at this farm from any cause which could be attributed to the exclusive feeding of lucerne hay or chaff has been nil over a period of three seasons.

HAYING.

Where the haying-implements comprise mower and automatic horse-rake only, the following method of saving medium hay crops has been found economical, and the hay produced quite good: When mowed, rake into light windrows as soon as the hay will leave the rake cleanly, the length of time between cutting and raking depending on the time of year, weight of crop, &c. First cuts require a proportionately longer period before raking, owing to the moist condition of the land and the sappiness of growth at that time. From windrows rake into small cocks or coils of from one to two fork-loads, using the horse-rake in the following manner: Take only half of the amount required for the cock in the first trip along the windrow. When the end is reached turn and rake the opposite way, travelling on the same track till the half cock is reached and giving it a half-turn in the operation. This makes a clean job and does away with trimming and topping, an operation which often involves a waste of time where high winds prevail. If rain falls before the stuff is fit to stack (as it so often does when the farmer has hay on the ground) the cocks should be left undisturbed for a day or two, when, if the weather has been favourable in the interval, most of the moisture will have settled to the bottom. When turned, a few hours should finish the drying with a minimum loss of leaf and resulting in hay of quite good colour.

International Seed-testing.—"Under the uniform system of testing and reporting proposed by the International Seed-testing Association," states the annual report of the Fields Division for 1927–28, "New Zealand, as a member, will be required to make a considerable number of special analyses on export lines. This will necessitate our strict adherence to the European system of testing, and it will therefore be necessary to make provision in staffing and equipment in the near future. These international certificates will be recognized in any country, and will be directly comparable with analyses made therein. This will result in the removal of many of the difficulties encountered in the export trade at the present time."

FARM-KILLED MUTTON AND PORK.

GUIDANCE FOR HYGIENIC EXAMINATION OF CARCASSES.

J. E. McIlwaine, M.R.C.V.S., Live-stock Division, Wellington.

It occasionally happens when a sheep or pig is killed on the farm for human consumption that some abnormal feature is met with on dressing the carcass. The following notes are intended as a guide for the farmer on such occasions.

Before an animal is killed it is well to note whether it appears to be in normal health in every way. An animal should not be killed for food if affected with severe diarrhœa or showing any symptoms of fever. It is advisable to have the selected animal fasted for twelve hours before being killed. The superior quality of much farm-killed mutton is in great measure due to the fact that the animals are not subjected beforehand to fatigue through travelling.

An apparently healthy animal having been selected and fasted, the slaughter is carried out, particular attention being paid to the fact that thorough bleeding is essential for the appearance and keeping-qualities of the meat. The internal organs should be removed as soon as possible after skinning is completed. This will prevent staining or discoloration of the carcass, which sometimes occurs when the entrails are left in position too long. There is also less danger of contamination with bacteria from the contents of the stomach and intestines.

Speaking generally, sheep in New Zealand are remarkably free from disease (and especially any disease likely to be transmitted to the human subject through consumption of their flesh). At the same time there are certain conditions which render the flesh objectionable and unfit for food. During dressing it is well to note the presence of any adhesions in the body-cavities. If such are associated with abscess formation it is advisable to reject the carcass. The seat of castration is sometimes subject to abscess formation, and this requires complete removal.

While thus examining the abdomen the presence of hydatid cysts in the liver or on the walls of the abdomen may be noted, and it sometimes happens that these cysts are seen in large numbers. The characteristic cyst is a thin sac or envelope containing a watery fluid. If ruptured and its lining examined with a magnifying-glass a whitish area will disclose the head or heads of future tapeworms. Any organs containing such cysts must be destroyed ; in fact, if the cysts are very numerous it is advisable to destroy the entire carcass. Here it must be strongly stressed that such rejected organs must not be given to the dogs on the farm without thorough cooking, as such a procedure directly infests the dogs with tapeworms. The infested dogs as a result will again contaminate the pastures, and cattle, sheep, or pigs grazing on such pastures will be later found the subjects of hydatids. These cysts often become degenerated through age. Then they show a cheesy appearance, are yellowish-white in colour, and of firm consistency. Organs containing such cysts should be condemned.

In the chest-cavity of the carcass the presence of hydatid cysts in the lungs may again be noted, and if any are present the lungs must

be effectively destroyed. The lungs normally are free and easily removed, and if any adhesion is seen between the lungs and chest-wall pleurisy has been the cause. As in the case of adhesions in the abdominal cavity, if only localized and no abscesses present the carcass is fit for use.

A disease of sheep known as caseous lymphadenitis, characterized by the presence of abscess formation in the lymphatic glands, requires to be looked for. These glands are more commonly spoken of as " kernels," and those most commonly affected in this disease are situated in front of the shoulder-blade in the fore limb, and in the hind limb those situated below and in front of the stifle-joint, when the carcass is hanging up. Occasionally such abscesses are deep-seated and only seen when the carcass is cut up, and sometimes abscesses due to this disease are seen in the lungs and liver. If one or two glands are affected, only the quarter concerned should be destroyed: if several are affected throughout the carcass it should be rejected entirely. The pus in such abscesses has a characteristic greenish colour.

In connection with pigs slaughtered on the farm for home use the remarks made regarding hydatids and adhesions in the chest and abdominal cavities apply as stated in the case of sheep. Abscess formation in pigs at the seat of castration is more commonly seen than in sheep, as are abscesses in the abdomen. A condition sometimes seen in pigs which have been fed extensively on whey is that of gas-formation in the membrane supporting the intestines; this condition does not affect the carcass, but is mentioned as it might be mistaken for something more serious.

In the case of the pig, however, there is one disease which requires particular attention when examining a carcass, and that is tuberculosis. As the lymphatic glands or kernels are the most common seats of this disease, particular attention must be paid to them, and as many as possible examined by cutting into them with a knife. As there is a greater tendency in the pig for the disease to spread, this point is most important. The viscera of the pig can be examined as they are removed from the body. A chain of these small glands is situated in the membrane immediately above the intestine itself, and, although only the size of a pea or a bean, their position when diseased will be easily recognized. Another small group of these glands is situated on the liver where the large vessels enter this organ. A third group is situated on each side of the backbone after evisceration. When the animal is affected with tuberculosis these glands are enlarged, and contain a whitish gritty material. At times they may also contain pus when the disease is active.

When the lungs and heart have been removed the glands of the lungs should then be examined. These are situated on each side of the windpipe where it enters the lungs. The lungs themselves may be affected, and can be examined by the hands for any hard centres, after which they may be cut into with a knife. In advanced stages the disease may be present on the lining-walls of either the chest or abdomen or both. The disease is here recognized by the presence of small whitish nodules the size of millet-seed or a pea.

The head now remains to be examined, and in this connection it must be mentioned that the glands here are more commonly affected

with tuberculosis than any of the others in the body. Although a number of glands are situated in the head region, only two will be mentioned here, and these are situated one on each side of the lower jaw to the inside of the bone in front of the angle of the jaw. If the glands of the head only are affected and the rest of the carcass is healthy, the head should be destroyed, and the carcass can be used.

In the inspection of carcasses for tuberculosis it may be laid down that when the internal organs are only slightly affected the carcass can be safely used for food after destroying the affected organs. If, however, the disease is extensive throughout the internal organs, or if any part of the dressed carcass itself or the glands contained in it are affected, the entire carcass should be rejected.

UTILIZATION OF PIGS IN COMMERCIAL ORCHARDS.

A MARLBOROUGH EXPERIENCE.

M. DAVEY, Orchard Instructor, Wellington.

THE useful purposes served by pigs in orchards from early autumn until the advent of spring have been realized by individual orchardists in New Zealand for some years past, but it is questionable if the full value which can be achieved by such usage is fully appreciated by orchardists in general. It is for the purpose of making more generally known the good results which can be obtained that these notes have been written.

Owing to the visitation of a violent hailstorm in the early part of last summer several orchardists in the Rapaura district of Marlborough suffered great depreciation of their apple crops, with the result that an unusually large proportion had to be regarded as rejects from almost the commencement of the season. The line of action taken by many of the growers was that of picking only that portion of the crop unaffected, leaving in many instances 50 per cent. of the apples on the trees, with the problem of the ultimate disposal of large quantities of useless fruit to be considered. It was decided that the introduction of store pigs supplied the best solution of the difficulty. So far as the results of the disposal of this refuse fruit were concerned, the pigs served the purpose efficiently and well, but another service also was effected, which probably was of more value and of more far-reaching effect than the clearing up of the fruit—namely, the cleaning up of the orchards.

One instance in particular came under the notice of the writer, particulars of which are given as follow: The orchard, which is approximately 15 acres in area, was in a very neglected state owing to several changes of ownership and faulty management in the past. Heavy tufts of cocksfoot and couch grass were growing as high as the forks of the trees. The land had been repeatedly ploughed towards the trees, and finally left in unbroken furrows. This was the deplorable condition of the place in May, when forty-four pigs were introduced.

The mob consisted of forty-one weaners, weighing about 15 lb. to 20 lb. each, purchased at an average cost of 10s. In addition three breeding-sows in pig were included. Thirty-seven weaner pigs were withdrawn and sold in August at auction, realizing 24s. to 30s. each, while four weaners were retained until October and sold as porkers, realizing £2 apiece. These pigs received no supplementary food during the winter, deriving their entire food-supply from the refuse apples and vegetation growing in the orchard. The breeding-sows, which were in pig at the time of introduction, were withdrawn during August in first-class condition, for farrowing.

Apart from the substantial increase in value of the investment, the improved hygienic and cultural condition of the orchard with the return of spring is the feature which demands attention. All cocksfoot tufts had been rooted up and largely eaten, couch which had been undisturbed for years around the stems of the trees had likewise been rooted out and dragged by repeated turning over away from the trees and killed, while useless apples—hail-marked, black-spot-infected, and otherwise diseased fruit — had been thoroughly consumed. The undesirable heaping-up of the soil around trunks was entirely eliminated, which in itself would have represented a costly and laborious operation if carried out mechanically, and the cost of which in the past was regarded by the owner as prohibitive.

For the information of readers it may be stated that such good work could hardly be expected on heavy land; the orchard in question is situated on light river-silt. The consensus of opinion among commercial growers in this district is that where pigs are used to clear up fruit lying on the ground after harvesting it has a marked effect on the reduction of black-spot infection in the succeeding spring. This is probably due not only to the destruction of the infected fruit, but also to the increased aeration of the infected soil.

Although it may be convenient to allow reject fruit to remain unharvested, a note of warning may be opportune regarding the retention of useless fruit on the trees. It is very noticeable with the return of the blossom season that only light crops promise where fruit has been allowed to remain far into the winter on the trees. For three reasons this practice was fairly general in Marlborough last season—namely, lack of size owing to droughty conditions, hail injury, and the retention of some control over the quantities made available to the pigs. The prolonged sustenance of the fruit on the trees evidently has an adverse effect on the development of the fruit-buds for the succeeding season, and would appear to be a most undesirable and unprofitable procedure.

Another feature noticeable where pigs were utilized for clearing-up purposes in *well* cultivated orchards was a clearly defined ring around the trees only being rooted up. The reason for such a habit on the part of the animals is rather obscure, but possibly it may be found in the pigs' partiality for the grass-grub, which infests the light soils in this district. The grass-grub beetles during mating swarm on the terminal foliage of the trees, and after fertilization descend to the ground for the purpose of laying their eggs. The well-defined rooting covered the same radius from the centre of the tree as the terminal foliage. Whether the pupa of the grass-grub, under limited food-supply, feeds on the fine fibrous roots of our fruit-trees has yet to be proved.

BUTTERFAT FIGURES FROM HERD-TEST AND FACTORY RETURNS.

SOME CAUSES OF VARIATION.

R. A. WILSON, D.S.O., Marton.

WHEN statements are made about the annual butterfat returns of herds it is often left in doubt whether herd-testing or factory returns are referred to; or if factory returns are given it is seldom stated whether the factory is making butter or cheese. It was in order to get some idea of the differences that the writer kept the returns for two herds last season. One of the herds was tested under Group herd-testing, and the other under Official Herd-test. It will be seen that the figures of both systems show approximately the same discrepancy between the calculated and the actual factory return. In both cases the milk was separated and the cream supplied to a butter-factory.

Details are given in the following tables; the losses are calculated as being on the herd-test figures.

Herd No. 1 : Group Herd-testing.

Month.	Number of Cows in Milk.	Butterfat in Test-sheets.	Butterfat in Factory Returns.	Excess of Factory.	Deficiency of Factory.	Percentage. (Approx.)
		lb.	lb.	lb.	lb.	
August	35	589	617	28	..	+ 5
September	52	1,970	1,317	..	653	− 33
October	55	2,317	1,821	..	496	− 21
November	60	2,432	2,068	..	364	− 15
December	60	2,576	2,134	..	442	− 17
January	60	2,354	2,124	..	230	− 10
February	60	1,750	1,711	..	39	− 3
March	60	1,828	1,664	..	164	− 9
April	60	1,502	1,450	..	52	− 3
May	60	1,213	1,149	..	64	− 5
Total	60	18,531	16,055	28	2,504	..
Average per cow	..	308	267	..	..	−13%

Herd No. 2 : Official Herd-test.

Month.	Number of Cows in Milk.	Butterfat in Test-sheets.	Butterfat in Factory Returns.	Excess of Factory.	Deficiency of Factory.	Percentage. (Approx.)
		lb.	lb.	lb.	lb.	
August	26	1,258	898	..	360	− 29
September	34	1,506	1,382	..	124	− 8
October	45	2,374	1,954	..	420	− 17
November	52	2,392	1,999	..	393	− 16
December	61	2,508	2,129	..	379	− 15
January	61	1,956	1,882	..	74	− 4
February	61	1,381	1,247	..	134	− 10
March	61	1,212	1,208	..	4	..
April	61	797	704	..	93	− 11
May	61	600	664	64	..	+ 10
Total	61	15,984	14,067	64	1,981	..
Average per cow	..	262	230	..	..	−12%

No comparison is intended between the two herds, as the circumstances were quite different. Herd No. 2 contained a large number of two-year-olds, and was much more affected by the dry season, as witness the quick falling-off in the autumn.

The results show a much greater discrepancy between test-sheets and factory figures than is generally realized. I therefore propose to give my investigation as to how far they can be accounted for.

Firstly, do the factory returns show the correct amount of fat, or is there an error here? Bulletin No. 109 of the Department of Agriculture, "The Overrun in Buttermaking," by G. M. Valentine, gives some figures to base an opinion on. He shows that with home-separated cream, with an average of 82·5 per cent. fat in the butter and with the loss in manufacturing calculated as 1·75 per cent., the overrun should be 19 per cent. Last year the factories in question showed an overrun of 22 per cent., so apparently they obtained more butterfat than they paid for. As the factories do not pay for fractions of a pound the gain is probably through this practice. It would seem that the gain is about 2 per cent. (The factories being co-operative concerns, the difference would, of course, be returned to the suppliers in another form.)

The variations between cow-testing and factory figures will now be examined. First comes the separator loss. Mr. Valentine shows in his pamphlet that skim-milk seldom contains below 0·07 per cent. of fat, which thus, with milk testing 4 per cent., amounts to 1·5 per cent. of the total fat. The average loss is probably about 2 per cent.

The most serious difference (one often not considered) is that for about six days after calving the milk contains too much colostrum to be used for separating for the factory and must be fed to pigs and calves, whereas the herd-test figures date from the day of calving. Six days is 20 per cent. of the first month, and as this is generally the heaviest month's production it is probably about 3·5 per cent. of the total annual production, assuming the cow's yield would be about six times her first month's production.

Then come the calves. Assuming that 25 per cent. of the calves are reared, and that they get 10 lb. of new milk a day for three weeks, and then taper off to skim-milk, and that the colostrum milk would represent the amount of new milk used in the tapering-off process, it would mean about 10 per cent. of one spring month's production, or, say, 1·5 per cent. of the annual yield. This, of course, is very approximate, as the circumstances vary so much. In my case I reared nearly 50 per cent. of the calves, so that probably more new milk was used. This was shown by the figures in the tables when the discrepancy becomes much smaller after December, when most of the calves were weaned.

Then comes the milk used by the household. Probably at least half the milk of one cow would be used, and if the herd was a fifty-cow one this would mean 1 per cent. With smaller herds it would be proportionately more.

Putting these items together we have the following: Shortage in calculation at factory, 2 per cent.; loss in separation, 2 per cent.; loss through colostrum, 3·5 per cent; fed to calves, 1·5 per cent.; house-milk, 1 per cent. This brings the total shortage loss out at 10 per

cent. The excess of the loss shown by my tabulated figures over this was probably due to more new milk being fed to calves.

With cheese factories the loss would undoubtedly be less, as probably there would be no calves to rear and no separator loss to allow for—but I have no figures in this connection. It would be interesting if some one could give corresponding figures for cheese-factory supply.

NOTE.—Certain other aspects of the subject dealt with by Major Wilson will be found in an article entitled "Herd-testing: Why Aggregate Association Records are higher than Factory Returns," by W. G. Batt, Farm Dairy Instructor, published in the *Journal* for June, 1923.—EDITOR.

STATISTICS AND THEIR RELATION TO AGRICULTURAL INTERESTS.

W. N. PATON, Farm Economics Branch, Fields Division, Agriculture Department.

THE collection of statistics dates back for thousands of years, the earliest on record (referred to by Herodotus) being a census about 3050 B.C. concerning the population and wealth of Egypt, required in arranging for the construction of the Pyramids. We thus see that the value of statistics was recognized in very early times. Such collections of data have occurred spasmodically throughout the centuries, when undertakings of unusual magnitude were being planned. It is only during the last fifty years, however, that statistics have been given full scope, and to-day there are few fields to which they are not applied. But many people are now asking, " Why this volume of statistics, and how much use are they when collected ? " Such people can hardly realize how much depends on statistics. Few new laws or regulations are brought in without their use ; in fact, progress in political and social reform depends largely on their collection.

There are many types of statistics collected, but they may be classified into two main groups—those of interest only and those of utility. We may discover from the collection of certain information a result which is interesting, but it may be impossible or unpolitic to apply it. For example, suppose that as the result of statistical investigation it was found that cows with naturally incurving horns were almost invariably high producers, but at the same time few cases of this occurred and that the characteristic was not hereditary ; what value would there be in such a finding ? Suppose also that men over forty years of age taking up farming for the first time were generally unsuccessful in their undertaking ; would it not be unpolitic to introduce legislation to prevent them taking up farms ? These are examples of " interest " statistics. But if incurving horns was a hereditary character we would know what cows to select for dairying and to breed from. Then the term " utility " statistics could be truly applied.

Uses for " interest " statistics may not be apparent at the time and may be discovered at later dates, or conditions may alter in such

manner that it would be politic to make use of them. However, the present aim of statistics is utility. It is the utility of statistics, and the extent to which they are made use of, which gives them their value. Statistics which possess far-reaching application may return in value to the community infinitely more than what may have been a costly collection. Cheap collection is not necessarily a saving.

FACTORS IN UTILITY STATISTICS.

Utility in statistics is obtained in five main ways—namely, (1) fundamental relation, (2) accuracy, (3) detail, (4) linking, and (5) applicability.

Fundamental Relation.—In planning a schedule or questionnaire care must be exercised in order that information requested shall apply to the fundamentals of the requirements of the collection. The closer answers relate to the problem under investigation the more valuable will be the resulting information. In order to achieve this, ambiguity must be entirely eliminated, so that no question may be misconstrued and consequently wrongly answered. Questions must be framed in such manner that they relate to the underlying causation of the phenomena to be studied. Naturally considerable knowledge of the subject is essential, and, moreover, foresight in considerable degree to provide for the possibilities of the investigation.

Accuracy.—Accuracy, as in the case of fundamental relation, depends on the successful elimination of ambiguity in questions. Questions, apart from being answerable in one way only, must be requested in understandable units—that is, units of every-day use. Moreover, the units in which answers are to be given should be definitely stated and, where necessary, carefully defined. Accuracy also depends on availability of information requested, and the manner in which the person approached treats the questions. All answers should be conscientiously supplied, and proper recognition of the value of statistics is necessary in order to achieve this co-operation. Detail is only valuable when it is correctly supplied. All carelessly compiled returns might as well be relegated to the waste-paper basket. Certainly small inaccuracies in detail are compensated for when large numbers of returns are available and resulting aggregates are essentially correct, but when such aggregates are submitted to close analysis subgroups often give ambiguous results. The law of compensating errors is a very useful one to statisticians, just as much as cumulative errors contribute largely to their worries. It cannot always be safely assumed that compensating rather than cumulative errors exist, and the best safeguard is accuracy in detail. The operation of the law of compensating errors must not be made the excuse for approximate returns where this is avoidable.

Detail.—Everything nowadays is becoming more and more scientific, and progress in science depends very largely on detail. Unless our statistics keep pace with this movement progress will be impeded. It is true to say that problems which may be investigated by a few simple questions are becoming rarer and rarer, those confronting us to-day not being possible of solution by rule-of-thumb methods as in the past.

That period is gone, and the new era calls for detail and more detail —in other words, scientific methods, for science is largely a study of detail.

Linking.—By " linking " is meant supplementation. One principal aim of all statistics should be the supplementing of one section by another. To ensure this quality all units of collection and presentation should be so designed that they possess interrelation properties. In this country, for example, a personal collection of data may be supplemented by a larger and more general collection by post, and these in turn by Dominion-wide statistics as compiled by the Government Statistician. The desirable feature of interrelation should exist not only between each collection, but also within each collection. Nothing does more for applicability of results than this provision of linking or supplementation.

Applicability.—Applicability of a result depends on how many uses it may have, and how far-reaching each use may be. The former is achieved by employing a general system of interrelating units—that is, linking; the latter by such measures as fundamental relation, accuracy, and detail. Applicability of results enhances the value of statistics immeasurably. The more uses to which a finding may be put, the more likely are results to be achieved. How far-reaching results may be is dependent on how vital are the findings applied. Use is the greatest value-contributor to statistics, and maximum use may only be assured by aiming for maximum applicability.

It is generally recognized that accurate detail is difficult to secure, but if accurate detail means success it certainly warrants more attention. People receiving questionnaires or schedules asking for information in considerable detail need not be unnecessarily perturbed at what is required of them. Far better that they be perturbed where accurate detail was not requested. Actually in the latter case it would be justified, but certainly not in the former. There is an old motto, " Nothing is worth achievement which does not involve hard work," and this is particularly true in the statistical field. To introduce more value into our statistics more work is required of the persons approached, and it is work which will be well repaid.

If the difficulty of securing necessary detail is permitted to render it expedient to adopt more or less general questions, the value of the resulting statistics will be lessened. If the person supplying information is to be " let off " furnishing this or that, the questionnaire or schedule may become so pruned down that it has little if any utility. Antagonism on the part of the person appealed to towards the collection of useful data is a decidedly short-sighted attitude. Antipathy results in half-measures, and this in turn in reduced utility and value.

TRADE INTERESTS INVOLVED.

The time has now arrived when all should recognize the great value of properly collected statistics. Better statistics mean more reliable information, and reliable information greater progress. Although the cost of collection and the time required of the person supplying returns may be greater, it will prove a real saving in the end. Such remarks as, " Why should I supply this information ? " or " Think

of the valuable time I spend each year filling in statistical returns" only go to show that there are people who fail to see more than their requirements of the moment. Discard all our statistics, and imagine how we could possibly compete successfully with other countries in the world's markets. The largest financial interests do not see fit to operate without having previously made an exhaustive study of all available statistics that bear on their field of interest. A similar service to the one which commercial men utilize is also available to the primary producer if he realizes the possibilities and co-operates in achieving it.

STATISTICS AND THE FARM SURVEY.

Agriculture holds an important place in New Zealand's statistics, but hitherto little has been done outside the work of the Government Statistician. One of the most useful applications of statistics to agriculture is the so-called "farm survey." The Farm Economics branch of the Fields Division is engaged in making a number of farm surveys covering all branches of farming, and wishes to stress the importance of this work to the agricultural community. The particular aim of the work is to obtain information relative to the connection between management and production. One farmer's experience is limited, and it often takes a lifetime for him to sufficiently solve his problems to be able to properly cope with them. The farmer can ill afford to experiment, nor does he like to be continually changing his methods. The effect of this generally results in adherence to certain old-established methods which do not necessarily give the best returns. One method is not always the best method, since results vary according to the type of farm. Generally speaking, farm-management problems do not suitably lend themselves to investigation by experiment, and it is here that statistical survey comes to our aid. For such purposes it is quicker, less expensive, and has greater scope than experimentation. Statistical farm surveys make the farmer their experimentalist, in so far that all the variations required for investigation are met with among the many farms covered by the field of inquiry.

In conclusion, proper recognition of the value of collecting statistical information must again be stressed, especially in the case of farm surveys, to which it behoves all primary producers to give their whole-hearted support. Co-operation is the key to the success of the movement, and on each farmer's co-operation, as much as that of others, may depend whether the service which it is aimed to render is to result successfully or not.

Cream-grading.—In his annual report for 1927–28 the Director of the Dairy Division remarks: "The compulsory grading of cream, and the payment of a differential price for 'finest,' 'first,' and 'second' grade cream, has been in operation during the whole year, and the beneficial effect of this is reflected in the high quality of our creamery butter. It is pleasing to record that the great majority of dairy companies have been whole-hearted in their endeavour to grade in accordance with the standards fixed by the Division. Some irregularities, inseparable from the introduction of any new method, have come under notice, but these have been corrected, and with few exceptions the system is now working on comparatively good lines."

POTATO-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926-27.

(Concluded.)

A. W. HUDSON, B.Agr., B.Sc., Crop Experimentalist, Fields Division.

IN the season of 1926–27 experiments were again conducted on the farms of Mr. L. C. Banks, Coutts Island, and Messrs. W. and A. Campion, Prebbleton. A further trial was commenced on the farm of Mr. W. Smith, Willowbridge. The experiments on Mr. Banks's farm are here designated Nos. 3 and 4; those on Messrs. Campion's Nos. 5 and 6; and those on Mr. Smith's Nos. 7 and 8. The method of conducting the experiments was described in the *Journal* for July, 1926, page 12.

The treatments used in Experiments 3 (Banks) and 5 (Campion) were as follows:—

	Quantity per Acre.
(1) Super, 42–44 per cent. tricalcic phosphate ..	3 cwt.
(2) Super, 42–44 per cent. tricalcic phosphate ..	5 cwt.
(3) Super, 42–44 per cent. tricalcic phosphate ..	7 cwt.
(4) Control (no manure).	

Each plot was three rows in width. Six replications of each treatment were sown in each case.

Experiment 3: L. C. Banks, Coutts Island.

Variety: Whites (mainly Northern Star). Date sown, 20th September, 1926. Date harvested, June, 1927. History of field: In grass for three years prior to experiment.

The crop was inspected on 17th November. All the manured plots were decidedly better grown than the controls, although the latter displayed a better colour. The 7 cwt. of super plots showed a decided superiority in growth over the 3 cwt. and 5 cwt. plots.

The results are set out in the following table:—

Table 3.—Experiment 3.

(The figures in each case represent the average of 18 plots each $\frac{1}{178}$ acre.)

Treatments.	Yield in Tons per Acre.				Profit as Result of Manure.
	Table.	Seed.	Small.	**Total.**	£ s. d.
No manure	6·05	2·53	3·49	12·07	..
Super, 3 cwt.	7·14	2·39	3·84	13·37	2 7 0
Super, 5 cwt.	7·47	2·71	3·77	13·95	2 19 0
Super, 7 cwt.	7·85	2·88	4·27	15·00	3 16 0

COMMENTS ON TABLE 3.

The method of valuing increases was described in the earlier part of this article under Table 1. The increase of just over 1 ton of table potatoes as a result of using 3 cwt. of super is highly significant, and shows a good profit. In this experiment the increased quantities of manure continue to furnish returns which are even more paying than with the smaller quantity.

Experiment 4: L. C. Banks, Coutts Island.

As in the preceding year on this farm, the manures used were :—

	Quantity per Acre.
(1) Super, 42–44 per cent. tricalcic phosphate ..	3 cwt.
(2) Super, 3 cwt., plus sulphate of potash, 1 cwt. ..	4 cwt.
(3) Super, 3 cwt., plus sulphate of ammonia, 1 cwt. ..	4 cwt.
(4) Super, 3 cwt., plus sulphate of ammonia, 1 cwt., plus sulphate of potash, 1 cwt.	5 cwt.

Another treatment, in which 1 cwt. of potash was top-dressed on 1 phosphate plot, was applied. This method of applying potash gave the same results as No. 2 above, and is therefore disregarded. In 1924–25 the application of potash as a top-dressing (see *Journal*, April, 1926, page 263) proved very beneficial, and the same method of treating with potash has been tried each season since. It has not proved of special benefit in either of the seasons subsequent to the first.

Details regarding date of sowing, &c., are the same as those for Experiment 3.

Observations during growing-period: On 17th November the plots receiving super and potash were not quite so well grown as those having super alone. All plots treated with the mixtures containing sulphate of ammonia were better in growth and colour than those having super alone.

The following table gives the results :—

Table 4.—Experiment 4.

(The yield figures in each case represent the average of 19 plots each $\frac{1}{178}$ acre.)

Treatments.	Yields in Tons per Acre.				Profit or Loss as Result of Manure.			
	Table.	Seed.	Small.	**Total.**		£	s.	d.
(1) Super, 3 cwt.	11·10	2·41	3·76	17·27	Profit	2	7	0
(2) Super, 3 cwt., plus sulphate of potash, 1 cwt.	10·88	2·30	3·91	17·09	,,	1	9	0
(3) Super, 3 cwt., plus sulphate of ammonia, 1 cwt.	10·43	2·38	4·23	17·04	Loss	0	15	0
(4) Treatment (3), plus sulphate of potash, 1 cwt.	10·44	2·61	4·45	17·50	,,	1	13	0

COMMENTS ON TABLE 4.

(1) The super is shown as bearing the same profit as that which it gave in Experiment 3 (Table 3). Potash has in no way affected the yield, and its use has considerably reduced the cash return.

(2) Super versus super and sulphate of ammonia: Although the difference between the *total* yields of these treatments is small and non-significant, there is a marked diminution in the yield of table potatoes and an increase in the yield of small, due to the sulphate of ammonia. The reduction in yield of the table grade is in marked contradistinction to the results of the two previous seasons. Whether soil or season has been responsible for the alteration is problematical.

Probably both factors contribute to some extent. In the season under review the sulphate of ammonia has been worse than useless on this farm.

(3) The addition of the potash to the phosphate and nitrogen combination has not improved the yield to a significant extent.

Experiment 5: W. and A. Campion, Prebbleton.

Variety: Dakota. Date sown, 14th October, 1926. Date harvested, 6th May, 1927. History of field: In grass five years prior to experiment.

Observations during growing-period: On 3rd December all superphosphate plots were markedly better in growth than the controls, the 7 cwt. quantity of super being the best of the manured plots. The appearance of the plots on 11th January can be seen in Fig. 5.

The results of the experiment are set out in Table 5.

Table 5.—Experiment 5.

(The yield figures in each case represent the average of 30 plots each $\frac{1}{100}$ acre.)

Treatments.	Yield in Tons per Acre.				Profit as Result of Manure.
	Table.	Seed.	Small.	**Total.**	£ s. d.
No manure	3·19	1·31	0·46	4·96	..
Super, 3 cwt.	4·05	1·59	0·56	6·20	2 2 0
Super, 5 cwt.	4·05	1·74	0·61	6·40	1 14 0
Super, 7 cwt.	4·18	1·72	0·62	6·52	1 11 0

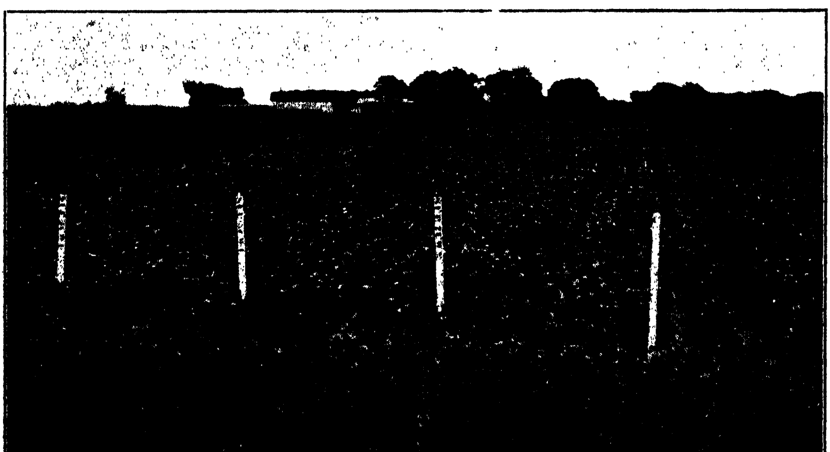


FIG. 5. EXPERIMENTAL PLOTS ON MESSRS. CAMPION'S FARM DURING GROWING-PERIOD.

The three poor rows to right received no manure. To their left the plots are—super, 7 cwt., 5 cwt., and 3 cwt. respectively. In the preceding season an equally striking difference in appearance between super and no-manure occurred, but without any actual effect on the yield of table potatoes.

COMMENTS ON TABLE 5.

The 3 cwt. quantity of super has yielded a significant increase in each grade, with quite a good profit of £2 2s. per acre. The increased quantities of manure have further increased only the seed potatoes to a significant degree, and their use has reduced the profit.

Experiment 6: W. and A. Campion, Prebbleton.

In this experiment the manures used were as follows, six replications being applied :—

	Quantity per Acre.
(1) Super	3 cwt.
(2) Super, 3 cwt., plus sulphate of ammonia, 1 cwt	4 cwt.
(3) Super, 3 cwt., plus blood (approx. 12 per cent. nitrogen), 187 lb.	4 cwt. 75 lb.
(4) No. 2 mixture, plus sulphate of potash, 1 cwt.	5 cwt.

Prior to the experiment under review, blood at 1 cwt. per acre had been used as the nitrogenous manure on this farm, with not very good results (see *Journal*, February, 1927, page 103, and May, 1926, page 323). In view of the success attending the use of sulphate of ammonia at Coutts Island, it was considered advisable to try this at Prebbleton. As indicated above, 1 cwt. of the sulphate of ammonia was used, and the amount of blood increased to a quantity equal in nitrogen content to the sulphate of ammonia.

Details regarding date of sowing, &c., were as for Experiment 5.

Observations during growing-period: On 11th January, 1927, the superphosphate plots were slightly inferior in colour and growth to the remaining plots, which were very uniform in appearance.

Table 6 gives the results of weighing.

Table 6.—Experiment 6.

(The yield figures in each case represent the average of 30 plots each $\frac{1}{185}$ acre.)

Treatments.	Yeild in Tons per Acre.				Profit as a Result of using Manure.
	Table.	Seed.	Small.	**Total.**	£ s. d.
(1) Super, 3 cwt.	5·26	1·46	0·48	7·20	2 2 0
(2) Super, 3 cwt., plus sulphate of ammonia, 1 cwt.	5·28	1·60	0·50	7·38	1 4 0
(3) Super, 3 cwt., plus blood, 187 lb.	5·26	1·58	0·50	7·34	1 4 0
(4) No. 2 mixture, plus 1 cwt. sulphate of potash	5·43	1·60	0·49	7·52	0 16 0

COMMENTS ON TABLE 6.

As in Experiment 4, the superphosphate profit is shown to be the same as that which occurred in the previous experiment. The yields are strikingly similar in this experiment, and the only significant increases in yield due to the nitrogen and potash are those of the seed grade; nitrogen and potash were quite unprofitable in use.

Experiments 7 and 8: W. Smith, Willowbridge.

The field in which these experiments were conducted had been previously cropped as follows: 1925–26, barley; 1924–25, wheat; 1923–24, potatoes; 1922–23, grass.

Extremely wet conditions were experienced after sowing of the crop on 2nd November, 1926. Unfortunately, much of the area was drowned out, and the crop proved to be a very poor one, due to no factor other than the weather conditions. However, it was considered advisable to take an estimate of the total yields.

Experiment 7 was the same as Experiments 3 and 5. A very unusual feature of this experiment was the fact that although all manured plots were better in appearance than the controls, the 3 cwt. super plots were decidedly better than those having 5 cwt. and 7 cwt. The plots were weighed on 26th May. Ten weighings were made in each treatment, the area of the individual weighed plots being 1/188 acre. Only the increases over control are shown in Table 7.

Table 7.—Experiment 7.

Treatment.	Total Increase over Control.
Super, 3 cwt.	1·8 tons per acre.
Super, 5 cwt.	0·6 ,,
Super, 7 cwt.	0·8 ,,

The superiority of super, 3 cwt., over the 5 cwt. and 7 cwt. treatment is statistically significant.

The manures used in Experiment 8 were as for Experiment 4, except that no potash was top-dressed. The plots receiving potash were better than those having super by about ½ ton per acre, although none of the differences proved to be significant.

General Conclusions.

Superphosphate at 3 cwt. per acre continued to give highly paying returns, and from results of the past three seasons its use is highly recommended.

Sulphate of ammonia did not fulfil the promise it showed in the two previous seasons. The benefit indicated by the improved appearance in the growth and colour of the crop in every case in which it was used did not prove to be paying, except at Mr. McIntosh's farm, Kaiapoi (see Experiment 1).

Sulphate of potash in the season under review in no case caused an increase sufficient to warrant its application.

Thanks are due to Messrs. McIntosh, McLenaghen, Banks, Campion, and Smith for their whole-hearted co-operation in the experiments. The efforts of Fields Division officers who ably assisted in carrying out much of the field-work and compilation of results are also much appreciated.

LAUREL POISONING IN STOCK.

A CASE OF DEATHS AMONG CALVES.

D. A. GILL, M.R.C.V.S., D.V.S.M., and P. MCGREGOR, M.R.C.V.S., Live-stock Division.

THAT the public in general, as well as those in charge of stock, should remember that laurel is poisonous is well exemplified by a recent case of which the following is a brief account.

In a certain township in Central Otago four weaner calves running out on the commonage died within twenty-four hours. The symptoms shown were sudden and acute. The beasts went down and lay struggling convulsively on the ground, frothing at the mouth and showing acute distress. After about ten minutes the convulsions ceased and the animals died quietly. In each of the four cases the illness only lasted—from the first signs till death occurred—about twenty minutes.

The last calf affected died in the evening, and a post-mortem examination was made next morning. The only abnormalities found were an inflamed condition of the fourth stomach and the small gut. The symptoms shown and the rapid death suggested that the calves had eaten some plant from which hydrocyanic acid (prussic acid) had been generated in the stomach. There are a number of plants and plant-products capable of this, and one of the commonest is the cherry-laurel (*Prunus laurocerasus*).

Inquiries were made, but apparently there was no laurel growing on the commonage or in the surrounding gardens, and it began to appear that this could not have been the cause. However, on making a thorough inspection several branches of the plant, some of which had obviously been partly eaten, were found in a piece of swamp by the roadside. Some time previously the local hall had been decorated in connection with a function held there, and a large amount of laurel had been brought in from the neighbourhood for the purpose. Later it was pitched out, and some children had dragged a large branch of it on to the commonage. Here much of it had withered, but that which had fallen into the swamp was still quite green and fresh.

All of this material that could be found was immediately collected and disposed of, and that the trouble with calves running on the commonage immediately ceased was sufficient confirmation of the diagnosis.

The leaves of cherry-laurel are poisonous to stock because in them is a substance called amygdalin and an enzyme (ferment), which under suitable conditions of heat and moisture interact to produce hydrocyanic or prussic acid. When the leaves are masticated and swallowed, conditions in the animal's stomach favour the rapid production of the poison, and death very quickly ensues. The inflammatory condition found present in the fourth stomach and small gut is not due to the hydrocyanic acid, but to an oily substance, something like turpentine, which is also present in these leaves.

WEEDS AND THEIR IDENTIFICATION.

ESMOND ATKINSON, Department of Agriculture, Wellington.

TUTSAN (*HYPERICUM ANDROSÆMUM* L.).

SOME of the weeds that have been illustrated from time to time in the *Journal* are included in one or other of the schedules of the Noxious Weeds Act. Such is the case with the one now shown—tutsan—which is on the Second Schedule of the 1928 Act (Third Schedule of the 1908 Act). Probably nearly all the scheduled weeds have been illustrated in New Zealand in the past, but there is very little uniformity in these illustrations, which are scattered through a number of different publications.

Apart from such things as the means used in making the original drawing and in reproducing it, there remains the factor of size, and as a rule very little attention is paid to this most important point. If one drawing is natural size and another half that scale, much of their value for purposes of comparison vanishes, no matter how clearly the degree of magnification is marked on each. It is thought that a complete series showing all the scheduled weeds without these disadvantages would be welcomed by many readers of the *Journal*.

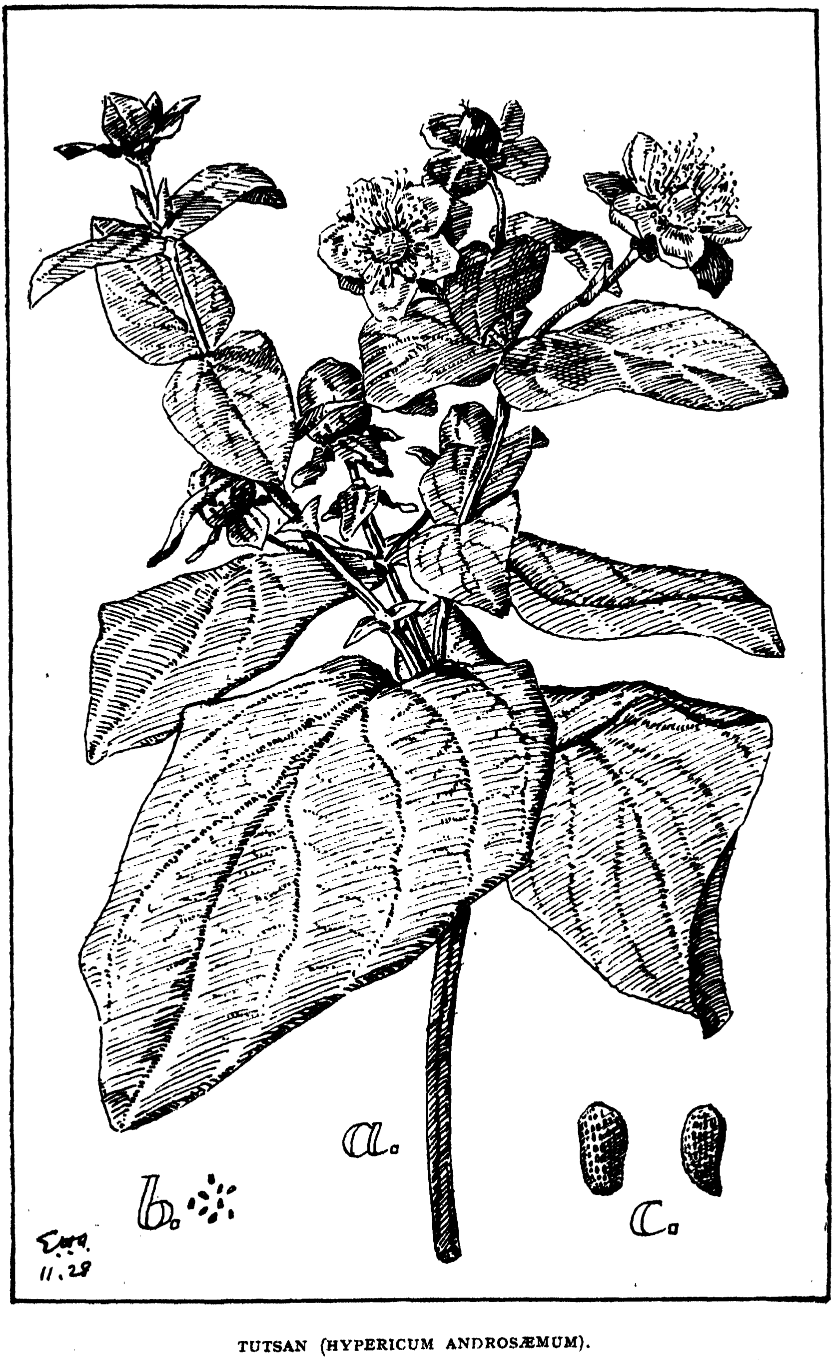
It will probably be generally admitted that the most adequate way of showing the general appearance of a plant is a life-sized coloured illustration. In these articles the colour has to be described in words, but (except where certain details are shown which are almost invisible to the naked eye—for example, "*c*" in the present illustration) the drawings are natural size.

DESCRIPTION OF TUTSAN.

Tutsan is something like the better-known St. John's wort (*Hypericum perforatum*) in appearance, but it is much bigger, with larger leaves and fewer and far less showy flowers.

It is a shrubby plant forming a bush 3 ft. or 4 ft. high, with stems which are more or less green and soft at the tips but quite hard and woody at the base. The stems have several "wings" or narrow ridges running along them, giving them rather the look of being angular in section. The roots of tutsan are not creeping like those of St. John's wort, and tutsan is never found as an aggressive weed of grassland. The leaves are stalkless and more or less egg-shaped, or sometimes even heart-shaped, and are arranged in pairs on opposite sides of the stem, each pair being at right angles to those above and below it (see figure). Masses of tutsan can often be recognized at a distance from their bronze-coloured leaves though they are green enough when quite young. In autumn this colour may range through many different purples to blood-red, and is almost the most striking characteristic of the plant.

The general appearance of the flower—which is pale clear yellow in colour—is shown in the figure. The fruit is quite fleshy and berry-like, and cannot be confused with that of St. John's wort, which is hard and dry, and splits open when it is ripe. Three of these fruits may be seen in the figure, half-concealed by the leaves; below are



TUTSAN (HYPERICUM ANDROSÆMUM).

(*a*) Flowering and fruiting branch, natural size; (*b*) seeds, natural size; (*c*) seeds magnified. [*Drawing by E. H. Atkinson.*

shown the seeds, natural size and magnified. The berries are decidedly attractive to birds, which play an important part in spreading the plant.

POSITION AS A WEED.

Tutsan, which is a native of Europe, West Asia, and North Africa, has been naturalized for very many years in New Zealand, where it has a wide distribution in both Islands wherever the situation is cool and damp. It may often be seen in great luxuriance lining the edges of small streams, and in many places (for example, the hilly country round Wellington) is certainly one of the most characteristic plants along the outskirts of forest that is gradually disappearing before changing conditions. Tutsan has a long flowering season, and scattered flowers may be seen at most times of the year, which is a fact worth remembering in connection with control, in view of the possibilities of it being spread by birds from odd berries. For control purposes the weed should be grubbed up and burnt wherever it is found.

FARMING OF BUSH-SICK COUNTRY.

SOME FURTHER RECOMMENDATIONS.

B. C. ASTON, F.N.Z.Inst., Chief Chemist, Department of Agriculture.

THE proper handling of "bush-sick" lands and treatment of affected ruminant stock is a matter of such importance as to warrant some recapitulation of information previously published in the *Journal*, together with amended and additional points suggested by later experience.

The use of double citrate of iron and ammonium in the prevention and cure of the iron-hunger which constitutes "bush sickness," has been so successful at the Mamaku Demonstration Farm that increasing numbers of settlers on the sandy silt and coarser pumice lands have taken advantage of this Department's offer to supply the drug to *bona fide* farmers at cost price—2s. 6d. per pound—through the Stock Inspectors at Rotorua and Tauranga. Evidence has accumulated that favourable results are being experienced by those who are using the drug and following instructions. It is important that careful attention should be given to these instructions, and they are here repeated for general information.

The dose for a cattle beast is 2 fluid ounces of a 6-per-cent. solution twice daily; for sheep one-fourth of cattle-beast dose. For younger animals the dose should be proportionately reduced, but the dose for a cattle beast should be not less than 1 oz. 1 lb. of the crystals may be dissolved in 13½ pints of water to make the necessary solution. The medicine is most effective for cattle when given as a drench.*

* Field work to discover the best method of treating sheep and lambs is at present being carried out by Mr. C. M. Wright, Country Analyst. The pellet method of the Rowett Research Institute, Aberdeen, gives promise of being successful. In this the prepared pellets, mixed with pieces of turnip, are placed in a trough. The sheep soon learn to eat the prepared pellets (a mixture of meals and mineral salts).

Some farmers have mistaken the directions to dissolve the drug in water and give 2 oz. of the solution, and have given 2 oz. of the solid scales. This is a serious mistake, and is likely to have injurious rather than beneficial results on the stock so treated.

It is convenient here to summarize the Department's recommendations for coping with iron-hunger in stock and farming lands of the volcanic " soil-province " classified as sandy silts and gravelly sands of Rotorua County. The soil maps of the county published in the *Journal* for June, 1926, and August, 1927, may be usefully referred to in this connection.

(1) Farm more highly ; harrow pastures freely ; get the plough in ; compact the soil (with a roller where possible) ; grow plenty of winter feed ; and save plenty of good hay free from mould. Subdivide into smaller paddocks, and keep the pastures eaten short. Top-dress with phosphate—preferably containing iron or in conjunction with iron sulphate ; a good programme is 2½ cwt. superphosphate mixed with ½ cwt. iron sulphate in autumn or spring, and ½ cwt. iron sulphate alone or with super in the following spring or autumn. Treat the stock well, especially in the matter of water-supply.

(2) Use molasses freely in the feeding, especially in rearing young stock. Regard molasses as a preventive, but not as a cure.

(3) When an animal shows signs of going back in condition owing to iron-hunger, give iron-ammonium citrate. Keep on with the treatment till the animals are healthy.

(4) Buy any stock required from districts remote from the affected pumice land, and under conditions which ensure that the animals are free from disease or parasitic infection. Lack of the mineral elements is known to predispose an animal to other diseases and ailments, which, when introduced on to a farm on sick country, run a rapid course among the stock.

(5) When rearing calves provide iron in the skim-milk, after giving them a good start with whole milk, and if possible follow with some good calf-food in the skim-milk. One fluid ounce of citrate solution should be put in each feed once a day for each calf.

(6) Put rock salt in paddocks in weatherproof places so that it will be available for stock.

The need for increasing the organic matter or " humus " content of pumice sandy lands cannot be too strongly insisted upon. Theory indicates that could green-manuring (ploughing-in green crops such as lupins) be introduced as a constant item of farm practice it would probably improve the nutritive quality of the herbage, and perhaps transform " bush-sick " lands into healthy country. The practical difficulties, however, have hitherto proved so great that it has not yet been possible even to demonstrate the truth of this theory.

Water for Butter-washing.—The improvement of water for washing butter in the process of manufacture is engaging the attention of several dairy-factory managers in North Auckland. The Bay of Islands Co-operative Dairy Company has installed a filter, and other concerns are considering the adoption of this method or treatment of the water by pasteurization.

SEASONAL NOTES.

THE FARM.

CROP-PRODUCTION.

In most places the sowing of swedes may be successfully extended into January, but if the weather conditions are very dry or sowing is delayed past the middle of the month it is usually more profitable to sow soft turnips than swedes. Imperial Green Globe is a suitable turnip for January sowing. Care should be taken that excessive quantities of soluble fertilizers are not sown with the seed, or the germination may be erratic. A mixture of super and rock phosphate, super and slag, or super and lime is generally more satisfactory than straight super.

In Southland and South Otago such crops as chou moellier, thousand-headed kale, and cabbage are generally sown before the middle of January. Chou moellier is of great value as a winter forage, as it stands frost well, has a robust habit of growth, and grows well in club-root-infected soil.

Italian rye-grass sown in January or February is an excellent crop for autumn, winter, and spring feeding. The use of this crop could well be extended in the arable farming districts, and it is one of the best crops to sow on summer-fallowed land.

Main-crop potatoes should be horse-hoed and moulded up as opportunity offers. Spraying should be done during early growth, and repeat dressings given as required.

CEREAL HARVEST.

Any slack days during the early part of January can be spent profitably in overhauling reaping-machines. The platform and elevator canvases should be carefully attended to. All broken slats should be renewed, and it is usually best to replace any that are at all cracked, as these generally break later on and may hold up the machine. The sprocket-wheels and driving-chains should be carefully examined. The wheels must be exactly in line and the chains run fairly slack, as they are liable to break if too tight. All oil-holes should be carefully cleaned out, and to make sure that none is missed it is a good plan to do the entire length of one shaft before going on to the next. When operating a reaper-and-binder, it is important to use good oil and lubricate the machine thoroughly. New machines generally require extra oiling.

Cereals should be cut as nearly as possible at the correct stage of ripeness. If cut too early the grain shrivels, and if cut too late there is a risk of loss by shaking. Four main stages or degrees of ripeness can be easily recognized. In the milky stage the contents of the grain when squeezed are fluid, and if cut at this stage the grain shrivels; next comes the stage of yellow ripeness, when the contents of the grain are doughy and may be easily cut through with the finger-nail; and in the fully ripe stage the grain is hard, but the straw yellow; in the final stage—dead-ripeness—the straw is white and the nodes shrivelled.

The time occupied by the grain passing from the first to the fourth stage depends on the season. In hot, dry weather the change is very rapid, and where large areas have to be dealt with a start must be made on the early side.

Wheat should be harvested in the stage of yellow ripeness. Owing to the prevalence of strong winds in wheat-growing districts and the serious loss that is often caused through shaking in a ripe crop, the wheat must be cut at a definite stage in yellow ripeness. The earliest stage that wheat can be cut without causing loss in weight from shrivelled grain is when the straw is yellow but the knots still green, and the grain when squeezed does not produce any dough but may be easily cut through with the finger-nail.

Oats can be cut slightly greener than wheat, and if intended for chaff early cutting is desirable. Oat varieties differ in evenness of ripening and liability to shaking. Dunns and Tartars, for instance, shake badly because the grain ripens very unevenly; Garton's Abundance ripens fairly evenly, but loses grain badly if left till quite ripe. Generally speaking, the crop should be cut when there is a nice uniform yellow all over, but just before the greenish tinge has entirely gone. The grain should be well filled and fairly firm, but not quite hard.

Barley for malting is usually left till dead-ripe, as if cut before this the germination of the sample is uneven, which is a disadvantage in the production of high-class malt. At the stage of dead-ripeness the ears tend to bend over, the individual grains are hard, with pale-yellow wrinkled skin, and the straw is practically dry.

Cereals should be stooked as soon as cut, and the work of stooking is lightened considerably if the reaping-machine is fitted with an efficient carrier and the man operating the binder drops the bundles in straight rows. The stooks should be placed so that the prevailing wind may blow straight through them. The crop requires at least a fortnight in the stook before it is ready to stack or thresh. If stacked it should not be threshed until at least six weeks after stacking, so as to allow completion of the sweating process to which the grain is subjected in the stack.

WEANING OF LAMBS AND CALVES.

The time of weaning and method of subsequent feeding of lambs depend entirely on the farm-management method adopted under given climate, soil, and topographical conditions. Where sheep are entirely grass-fed, weaning should take place while there is still plenty of good grass available, and the lambs should be placed on the best pastures. In this way they get used to foraging for themselves before the grass goes off in the autumn.

The management of fat lambs is rather different from that adopted for flock sheep. Under North Island conditions it is usually possible to get 80 per cent. or over of Southdown-cross lambs fat off their mothers, and the remaining lambs will be weaned after the last draft of milk lambs has been got away. In the drier, arable farming districts rape is necessary for fattening the majority of the lambs after the grass dries up in midsummer. Lambs should be

allowed a day or two on grass paddocks to settle down after weaning, before they go on the rape. Rape is a very heating food, and the lambs on this crop should be watched carefully. Mustard is a good dietetic, and should always be sown with rape. As the mustard matures earlier than rape it should be sown about a fortnight later. A run-off from the rape on to a grass pasture is also desirable.

Early weaning is generally desirable in the case of calves. If weaned at four or five months they get used to foraging for themselves before the grass goes off badly in late summer or in autumn. The more adequate feeding of calves during the dry weather is a point which could receive more general attention from dairy-farmers. If the pastures dry up badly the calves should receive some green feed. If soft turnips are being fed out to the milking-cows the calves can be allowed access to these roots before the cows. They usually confine their attention to the leaves, and thus will minimize the tainting effect of the turnips when eaten by the cows.

—*P. W. Smallfield, B.Ag., Fields Superintendent, Auckland.*

THE DAIRY-HERD BULL.

The number of cows to be allotted to a bull naturally varies a great deal, depending on his age and abilities. It often happens that a young sire (upwards of twelve months) is purchased at the beginning of a season, but in many cases too great a use is made of him, with disappointing results. Although mature enough in a way, his service should be light for the first season, not exceeding twelve to fifteen cows. If a procedure of this sort is carried out, by the time the bull is two years old he should be capable of serving a herd of up to fifty cows.

Many farmers train the bull when young to " bail up " like the cows. This is a good practice, as it facilitates handling when it becomes necessary for any reason. The herd sire should have a ring inserted in his nose, be dehorned, always handled with care, and never given a chance to learn to use his strength. The remark is often heard that a bull is very quiet, but a large proportion of the accidents which occur are caused by quiet bulls being trusted too much. The animal should be so handled that he recognizes the man as his master.

At this time of year some dairy-farmers are apt to allow the bull to run indiscriminately with the herd. This practice is to be condemned if the best results are to be obtained. He is best kept in a handy paddock close to the milking-shed. The advantages of having the bull separated from the herd are numerous, and may mean the difference between a good and a bad season, because if any trouble arises it will be noticed almost immediately, and the necessary steps can be taken to remedy it; whereas if the bull is running with the herd it may go unnoticed for days.

When a cow comes in season she should be taken to the bull, and the common practice of leaving her with him until she has been given two services is quite sufficient. In this way the bull's service is not wasted, nor his strength unduly drained. A careful note of the date of service can be taken, and thus the calving dates of the various cows are always known, whereas if the bull is running with the herd

the services are often noted by guesswork, which is very unreliable and liable to disorganize the next calving programme for the herd.

Care should be taken that some shelter from the weather is provided for the bull, either by a live hedge or a suitable shed. A good supply of water and feed are essential for the welfare of the animal. Especially during the winter months he should receive a liberal supply of good hay and roots, so as to enable him to be in good order for the ensuing season. The addition of a small amount of concentrated feed, such as crushed oats, bran, or linseed, will prove beneficial. The bull should never be overfat, but kept in a good thriving condition.

—*Live-stock Division.*

THE ORCHARD.

SPRAYING OPERATIONS.

THE holiday season is approaching, and most orchardists are looking for a short interval in the task of spraying, thinning, and cultivation. It may be presumed that the work is well in hand and the orchard in real good condition in every respect, and unless one is growing stone-fruit, requiring harvesting at the time, the work has no doubt been so arranged as to provide for a brief interval from actual labour.

The season is now about half through, and this definite break may be an opportune time to review the work as far as it has gone and record results. Possibly black-spot occurred on certain varieties or on certain portions of the orchard. It may still be possible to place a finger on the weak spot in the defences and to derive a lesson from any failures. Such questions as the following may be asked: Should I have repeated a spray application when rain followed immediately? Should I have reduced my intervals between sprayings early in the season? Should I always test my bordeaux mixture to avoid injury by an acid solution? Should I have used Black Leaf 40 at the calyx stage and saved myself an attack of leaf-hopper? Was it safe to rely on sulphur pastes for control of black-spot, or should I have continued with lime-sulphur longer? The answers to these and similar questions are often available to the orchardist in his own orchard.

In deciding on a spraying programme for the remainder of the season various factors must be considered—the condition of the foliage, freedom from red mite or otherwise, prevalence of leaf-hopper, weather conditions in relation to black-spot development, and so on.

If the foliage on apples is clean and danger of black-spot is not imminent, one of the sulphur pastes may be regarded as the standard spray, used of course in combination with arsenate of lead, 1½ lb. to 100 gallons, for control of codlin-moth and leaf-roller caterpillar. Where an economical control is required for all pests and diseases, a combination of lime-sulphur, sulphur paste, and arsenate of lead is more reliable, using ⅝ gallon lime-sulphur, 8 lb. sulphur paste, and 1½ lb. arsenate of lead, to 100 gallons.

Early apples, such as Gravenstein, should not be neglected after picking, but should receive at least one more spraying of sulphur

paste for the control of mildew. Pears will still require arsenate-of-lead sprays for the purpose of controlling codlin-moth and pear-slug. On apples and pears, spraying should be continued to within a fortnight of picking.

Stone-fruit should still receive attention, using ⅝ gallon lime-sulphur and 6 lb. sulphur paste to 100 gallons. If red mite is absent a sulphur paste alone, or the dry-mix sulphur, and lime, would be preferable for brown-rot control. Cherry-leaf or pear-slug will now be prevalent, and stone-fruit trees should be protected. If it is found necessary to spray when the fruit is nearly ripe, hellebore powder, 1–20, is preferred, as no staining of the fruit results, otherwise arsenate of lead may be used.

CULTIVATION.

Land should be kept in good tilth during the coming month not only for the purpose of conserving moisture, but in preparation for the sowing of a cover-crop of lupins. It is preferable to drill in the seed to secure the benefit of the moisture, which is usually a few inches below the earth mulch. Good germination is assured even in a comparatively dry season, and the deeper-rooted seedlings will survive a drought.

THINNING.

The main thinning of pip-fruit should be completed by now. However, it is still advisable to go over the trees again where the thinning appears inadequate, as usually it does where the set has been heavy. Diseased and misshapen fruit should be removed at this stage and not allowed to develop further.

HANDLING OF THE PIP-FRUIT CROP.

The general remarks in last month's notes concerning the handling of the stone-fruit crop apply to the handling of pip-fruits. Picking, whether for local market or for export, should be by selection, taking only those fruits which have attained a size and maturity required for the particular market. The more pickings taken from a tree the better the average sample. The local markets require as much consideration as overseas markets, and should not be regarded as a dumping-ground for low-grade fruit.

Grading and packing should be done carefully. Clean new packages, well packed, clearly branded and describing accurately the contents, give buyers confidence. The picking of fruit for export should receive very special consideration, especially in regard to maturity. While overmaturity is a serious fault in fruit intended for overseas, the picking of immature fruit is just as serious, and must be avoided. There is always a temptation to make an early picking to ease trees of a load. The writer can only recommend the orchardist to exercise extreme patience, and few days' wait often makes a wonderful improvement in colour and quality, and gives the grower a reasonable pick of good fruit, instead of having to scrape to secure sufficient doubtful fruit to handle as a line. Fruit gathered under such circumstances is disappointing when brought into the packing-shed. It usually looks better in the bright light of the orchard.

BUDDING.

Stone-fruit trees, which are usually reworked by budding, will be ready for this operation during the coming month. Cherries come first, followed by plums, then peaches and nectarines. The latter may be budded up till the end of February. Three important points in connection with budding may be noted: Buds which are taken from new shoots must be from bud wood still showing growth, otherwise they will be too ripe; there must still be growth in the stock, otherwise a union cannot take place; stock wood should be of the same age as the wood the buds come from.

—*N. J. Adamson, Orchard Instructor, Hastings.*

Citrus-culture.

A feature of the citrus-groves this season is the remarkably heavy flowering and the rather impoverished condition of the foliage, both no doubt in large measure attributable to the dry conditions of last summer and autumn, which brought about a well-ripened-wood condition. With this abundant crop and weak foliage, trees will require more than the usual care during the summer if the fruits are to be well developed and the trees improved in tone.

Cultivation: The land should be worked to a fine tilth as early as possible, and this maintained. If it is not possible to maintain at least 4 in. of the surface soil in a finely divided state, trees should be mulched to at least the spread of the branches with rough litter or manure, and the land between the trees kept worked and free from weeds or other crops.

Manuring: The heavy flowering and strain of fruit-set and pip-development will have exhausted most of the readily available fertilizers applied in the spring. It will be advisable to apply nitrogen in the form of nitrate of soda or sulphate of ammonia periodically, following showers of rain, throughout the season. An amount of 2 lb. per medium to large fruiting trees is a good application for late December, with a further 1 lb. at any rainy period in late January or February.

Pruning: With an abundant crop of most kinds of fruit, thinning is resorted to in order to improve the quality of the fruit and lessen the strain on the tree. While it is not practicable to thin citrus fruit in such a way, the same general principle applies; but in this case the crop is best reduced by pruning away or shortening back the semi-worn-out type of wood least able to mature good fruits. While many growers have not been inclined to do this in the general spring pruning, when dead and cross wood only was removed, with a good crop now in sight it is not too late to prune back the weaker lateral fruiting twigs. At this season these will revegetate and provide foliage to the immediate benefit of the tree, also furnish young laterals for future fruiting. Young trees not yet in fruit will be making strong growths, which if perpendicular and not required in the framework should be cut back to induce side growth, or if wanted for the formation-work lightly tipped to ensure stability. Where strong growths are of a flatter or pendular type they should be spaced and lightly tipped to form side-growths along the stem, rather than the bushy tip-growth which naturally arises on unstopped growths.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

MANAGEMENT OF THE YOUNG STOCK.

Now that the season for incubating is over and the bulk of the chickens reared to an age when they have passed the chief danger-period of their development, the poultry-keeper may look forward to a somewhat easier time than recently. There is, however, plenty of work to do if the plant is to be maintained at a high standard of efficiency. For example, it must not be concluded that because the young stock have passed the brooder stage special care and management are no longer essential. Especially does this apply to the growing pullet. If it is to develop into a vigorous specimen (and it can be only profitable if it is vigorous) it must never receive a set-back from the time of leaving the shell till reaching maturity.

One cannot overemphasize the importance of classifying the young birds according to their size and age, remembering that the more evenly the birds are graded the better will they thrive. This applies to the younger members of the flock in particular. It is a common practice, but nevertheless a mistaken one, to feed both the growing and the adult stock on the same class of food. I have recently come across cases where the morning mash contained a high proportion of forcing-material, such as meat or blood meal, which was being supplied to all members of the flock, irrespective of age. Such food is specially demanded in the case of the heavy-laying bird, particularly when it is intended to cull her out at the termination of her laying season. With the growing bird, however, such a forcing diet is quite unnecessary. The food supplied at this age should contain the elements needed to build up frame and bone, rather than to develop the egg organs—in other words, to encourage prematurity, a condition that the overfeeding of meat is sure to bring about.

It is not generally known that when a pullet commences to lay she ceases to grow. Obviously if a bird commences to lay at an early age it will remain a diminutive specimen of its breed, and thereby fail to produce a good marketable egg. It is sound practice to give chickens a good supply of animal food—say, up to eight weeks old—but between this period and until the pullets are well developed and nearing a laying-point, forcing-food should be sparingly provided. Indeed, if it is observed that the pullets show signs of coming too early to maturity, all forcing-food, such as meat or its substitutes, or even milk, should be left out of the ration. Unfortunately, many poultry-keepers have been led to force their pullets owing to incorrect teaching that early maturity is an indication of egg-laying power, and that premature laying is a sign of the desirable breeding-bird. There is no greater fallacy.

Perhaps the most important fact disclosed relative to the grading of eggs for export during the past season (and on which more will be said in these notes at a later date) was the excessive number of undersized eggs which reached the depots, and which were next to useless for the overseas trade. It should be the aim of every utility poultry-keeper to correct this tendency. It will certainly never be corrected—on the contrary, it will be encouraged—if pullets are to be forced to commence laying before they are thoroughly fitted for the work.

Of course, I am not speaking of the early laying of the well-developed bird but of the pullet which commences to lay when only a little more than half the standard weight of its breed.

The importance of marking the young stock as a future guide to separating the birds according to age is not appreciated as it should be. All birds hatched this season should be promptly marked without delay. Perhaps the simplest method is to punch a hole in the web of the foot, reserving a particular section of the web of each bird for the particular season. A suitable punch for the purpose can be procured for about 2s.

RIDDING FOWLS OF LICE BY NICOTINE PREPARATION.

Having been advised that a Californian poultryman (W. R. Stewart) had discovered a new method of controlling external parasites in his poultry flock with Black Leaf 40 (a by-product of tobacco), it was recently decided to try this preparation for freeing fowls of vermin at the Wallaceville Poultry Station. The result of the experiment was most satisfactory. Not only did the material have the effect of rapidly killing all kinds of insect pests that happened to be on the birds, but the treatment in no way upset the flock. The low cost of the necessary material, and the short space of time required for its application as compared with the methods commonly employed in ridding fowls of vermin, such as dusting with insect-powder, dipping, &c., are greatly in favour of the new method. Not only this, but the catching and handling of each bird for the purpose of dusting must necessarily upset the flock, and be followed by a reduced egg-yield.

It is estimated that from 2½ lb. to 3 lb. of Black Leaf 40 will be sufficient to free 1,000 birds of any lice that may be upon them. The material for this number can be effectively applied in about fifteen minutes, and the following is a good way of doing so: Make a small hole in two opposite corners of a small tin containing the material, and pass it along each perch, leaving a thin line of the liquid on the perch. Do this at dusk, just before the birds go to roost. For the treatment to be really effective it is important that all birds shall go or be placed on the perches, and not allowed to roost in odd corners of the house. Birds that are in broody-coop, &c., may be freed from vermin by dipping a feather into the liquid and drawing it under both wings, or by putting a small amount on the breast-feathers.

There are many kinds of insect vermin which attack fowls. The object, however, of the experiment referred to was to kill those kinds which live continually on the body. Among those most commonly known to poultry-keepers is the ordinary body-louse. Its favourite location is surrounding the abdominal region. Then there is a distinct form of louse which affects the head. There is also the depluming mite, of minute size, which is usually found at the root of the feathers. Another form of louse, which is probably more responsible for birds acquiring the habit of feather-pulling than any other cause, is usually located on the quills on the inside of the wing-feathers. One may reasonably assume the feather-pulling habit would soon disappear from flocks troubled in that way if the Black Leaf 40 treatment for lice were resorted to.

As opportunity arises further experiments will be conducted in dealing with parasites, both internal and external, which are seriously affecting the profit-making power of so many poultry flocks in the Dominion.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

RETURNING SWARMS TO PARENT HIVES.

SWARMS in January are of little value except as increase for the next season, and should be returned to the hives whence they originated if these can be traced. It is a good plan to kill the old queen in the swarm when returning it, at the same time destroying all but two queen-cells in the parent colony. If the hive is cramped an extra super may be given, and with this inducement the colony will usually settle down at once to work.

After-swarms should always be returned to the parent hive. They are easily disposed of even if the beekeeper does not know whence they came. If they are shaken through an excluder into an empty super the virgin queen or queens can easily be picked out as they attempt to force their way through, and once these are removed the bees will return to their old home. The young queens can then be used to replace poor queens in the apiary. It is an excellent plan to have one or two queen-cages always on hand. The young queens can each be confined in a separate cage, and when the queen to be destroyed is removed the closed cage containing the virgin can be placed on top of the frames and left there for twenty-four hours, during which time she will be fed by the bees in the hive. At the end of twenty-four hours she can be released and allowed to run down into the frames, when she will be accepted by the bees.

VENTILATION.

The matter of ventilating the hives should by now be receiving every attention. Every means should be used to ensure the bees having an abundance of fresh air day and night. All weeds and other obstructions should be removed from the fronts of the hives, and the entrances enlarged as much as possible. In extreme cases the hive-bodies should be raised from the bottom-boards by means of small blocks of wood. On no account should the bees be allowed to cluster outside the hives, and wherever they show a tendency to excessive fanning steps should be at once taken to increase the supply of fresh air to the colonies.

SUPERS.

One of the necessities of a well-regulated apiary is an abundance of supers when the honey-flow is in full swing. Every inducement should be given the bees during the often brief season to gather in every available drop of nectar. No beekeeper with business acumen will allow his bees to loaf or cluster outside the hives for lack of storage room. It is well when adding extra supers to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

It should be understood, however, that supering must not be overdone and the bees disheartened by being given too much work at one time. On no account add a second super until the bees are well at work in the first, and in cases where the colonies are only building up well at the beginning of the honey-flow—that is, where a poor colony has been requeened and the new queen's brood has not as yet hatched —it is an excellent plan to tier up with half-stories. Many an apiarist has had a moderate return from a small colony with half-stories, when it is doubtful if any return at all would have been obtained by the use of full-depth supers.

QUEEN-EXCLUDERS.

January is the month when queen-excluders are of most use, especially in southern districts. Whatever their disadvantage may be in some localities, in the South they have proved their efficacy in enabling extracting to be finished before the hot weather goes, without the destruction of any brood whatever. Excluders should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queens confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder. If this happens the queen-cells should be destroyed, as the queens which would emerge from them would not be able to pass through the excluders to get mated, and would in time develop into drone-layers. By providing the queen with plenty of empty combs she will be able to cultivate laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Excluders are often condemned as being productive of overswarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences, and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

FOUL-BROOD.

Foul-brood, unfortunately, is all too common in some localities, and in consequence beekeepers may at any time have a visitation. No one, however, should look upon foul-brood as a necessary evil—it can be cured. It is unknown in some parts of New Zealand, some apiarists who have been keeping bees for ten years or more never having seen it. Other districts that have in the past been troubled with the disease are now free from any sign of infection.

There is therefore no excuse for the presence of foul-brood in apiaries situated in open country; its presence is explained by carelessness on the part of the beekeeper. There is no remedy for

American foul-brood superior to the McEvoy treatment, which has been frequently described in the *Journal*, and is more fully dealt with in the Department's Bulletin No. 119, "American Foul-brood in Bees and its Treatment," which can be obtained free on application. Carelessness in dealing with foul-brood must result in heavy losses, and eventually in the destruction of the whole apiary. Make a point of treating any colonies found to be infected; though there may be only a few cells of disease showing, the infection is there, and it is not safe to trust to any methods less than the full McEvoy treatment. On no account put supers on infected colonies; this will only increase the quantity of material that must eventually be destroyed to ensure the eradication of the disease.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO CROP.

At this period the tobacco-plant reaches the blossoming stage, and the main stem completes its growth with a spike of flowers. In a good average crop the majority of the plants will reach this stage at the same time, and the operation of topping should then be carried out. When the flower-buds are allowed to remain the leaves are deprived of a certain amount of nourishment and soon deteriorate. For this reason the plants are topped by breaking off the spike of flower-buds and dropping it in the open space between the rows. In some instances, more especially for air-cured tobacco, the small bottom leaves are removed (primed) and placed out in the middle of the lane to wither. If these pieces are left in the shade under the plant or are allowed to fall on the leaves, decay will be set up and considerable damage may occur.

To carry out these operations satisfactorily the grower must carefully consider the circumstances and instruct his assistants accordingly. The length of stem to be topped off, and the number of bottom leaves (lugs) to be removed, depends on the condition of the plant and the weather at the time. If too much is taken away from a strong plant in good growing weather the remaining leaves, which form the crop, will become coarse, and strong shoots will develop in the axils (base) of the main leaves. Such coarse ribs and veins make curing difficult, and result in an inferior article when manufactured. On the other hand, if too little is taken from the plants the main leaves are deficient in size and texture, and some are immature when the plant is harvested.

In any case shoots will develop at the base of the main leaves about a fortnight after topping, and to prevent them robbing the main leaves of sap to complete their full development they must be broken out before they exceed about 3 in. in length. This operation — known as suckering — will have to be repeated probably a second time before the plants or leaves are harvested.

At this stage it is necessary to prepare for harvesting and curing the leaf. Sheds that are to be used for this purpose should be

cleared and cleansed, especially from any moulds that might infect the leaf. The exact period of ripening cannot be anticipated, as it depends very much on the weather. For this reason it is advisable to make early preparation to enable immediate advantage to be taken of suitable weather conditions as soon as the plants are ready.

TOMATOES AND CUCUMBERS UNDER GLASS.

Owing to rough weather in early November most of the outdoor tomato crops are late, and the demand for crops grown under glass should be good. The latter will now require careful feeding with liquid fertilizers fortnightly, and watering in dry situations. Ample ventilation is also required at this season, but cold winds blowing through the house must be avoided; serious damage is often done to crops by neglecting this attention at the present stage.

There is a quantity of tomatoes on the market at present in a watery condition and ripening in a very patchy manner. Such samples are in very little demand, and are likely to check consumption. The trouble may be easily avoided if more attention is given to the proper use of fertilizers. Very commonly growers are inclined to favour manures that give increased growth, and they neglect those whose effects are not quite so obvious. Of the latter potash is one of the most important, as it has a great influence on the constitution of the plant and the colour and flavour of the fruit.

Cucumber-plants under glass that are about exhausted by cropping may now be discarded, and the house thoroughly cleaned up and replanted.

BERRY-FRUITS.

Most berry-bearing plants that have had their crops gathered will now be benefited by careful summer pruning. In gooseberry-bushes strong water-shoots growing from the centre or the root should be cut out completely. In red currants superfluous strong laterals or growth from the base should be removed, and the remaining laterals shortened to induce increased cropping. The bearing-canes of raspberries should be cut out at the surface of the ground, and carefully carried out and burnt, removing also weak and unnecessary young shoots. As next season's crop of fruit depends on the crop of young canes now developing, they should be given every attention. In the strawberry beds mark sufficient plants of exceptional merit for planting out later for the special purposes of producing runners next season.

VEGETABLE CROPS.

In most districts, dwarf beans, peas, carrots, beet, turnips, lettuce, and spinach may be sown now for profitable late crops.

Carefully select seed from the early potato crop, choosing tubers from healthy plants with well-furnished roots. Spray the late potato crop in districts subject to late blight, using home-made bordeaux, 4-4-40 formula, and repeating the application at intervals of a fortnight. Two or three applications will be required.

Important crops for harvesting in autumn, winter, and spring that should be planted out now are cauliflower, savoy cabbage, leeks, celery, and broccoli. Spray the plants well in the seed-beds before

shifting them. Give the celery-plants bordeaux, and the remainder a mixture of tobacco concentrate and arsenate of lead. Soak the beds well with water the day before lifting, and when that is done select good plants of even size, place them in trays, and leave them in the shade until they are required in the field. Choose dull weather for this work, if possible; otherwise put out the plants during the afternoon.

For spring crops requiring heavily manured ground obtain what supplies of organic manures are available, and see that the material is properly stored and cured ready for ploughing in in early winter. The simplest way is to stack the supplies in a compact heap as they are obtained; they will then ferment and be less subject to leaching. Seaweed is excellent material for this purpose, and is specially suitable for sandy soils by the seaside. Soot and wood-ashes are particularly valuable, and should be kept dry under cover. Among the larger crops, such as tomatoes and cabbage, it is sometimes customary to sow a green cover-crop, so that after the harvest there is considerable green growth to plough in. Where other organic manures are scarce this is an excellent supplementary source of supply.

THE HOME GARDEN.

In most parts of this country the autumn months are most suitable for garden-making, and where work of this kind is to be done consideration should now be given to it. For recreation and shelter, for appearance and supplies of fruit and vegetables, the country home garden is of sufficient importance to demand careful forethought before the work is commenced. The work should be sufficiently advanced for sowing lawn-grass seed or laying turf in March. Herbaceous plants may be planted then. Trees and shrubs in the nurseries will not be ready for removal until May or June. Local experience, good literature, and visits to the local nursery will, if time and thought are given to the matter, supply ideas and information that will be very helpful in obtaining satisfactory results with a minimum of disappointment.

—*W. C. Hyde, Horticulturist, Wellington.*

AGRICULTURAL SHOWS, SEASON 1928-29.

THE following show-dates have been notified by agricultural and pastoral associations:—

Horowhenua A. and P. Association: Levin, 29 h and 30th January.
Feilding A. and P. Association: Feilding, 5th and 6th February.
Tauranga A. and P. Association: Tauranga, 5th and 6th February.
Dannevirke A. and P. Association: Dannevirke, 12th and 13th February.
Te Puke A. and P. Association: Te Puke, 13th February.
Masterton A. and P. Association: Solway, 19th and 20th February.
Whakatane A. and P. Association: Whakatane, 20th February.
Opotiki A. and P. Association: Opotiki, 23rd February.
Te Awamutu A., P., and H. Association: Te Awamutu. 20th February.
Taranaki Metropolitan Agricultural Society: New Plymouth, 6th and 7th March.
Morrinsville A. and P. Society: Morrinsville, 13th March.
Mayfield A. and P. Association: Mayfield, 23rd March.
Methven A. and P. Association: Methven, 27th March.
Flaxbourne A. and P. Association: Ward, 18th April.

TESTING OF PUREBRED DAIRY COWS.

NOVEMBER C.O.R. LIST.

Dairy Division.

THE period of the year has now arrived when certificates of record are being issued in comparatively large numbers. During the month of November certificates were awarded to seventy-two cows, and it will be seen from the appended list that many of the performances are of exceptional merit.

NEW AYRSHIRE CLASS-LEADER.

Despite the fact that the majority of the class-leaders for the various breeds have now reached a very high standard, class-leaderships are increased more frequently than might be expected. The latest change falls in the Ayrshire mature class, the new leader being Mr. W. Moore's Floss of Braeside, whose yield of 832·72 lb. of butterfat is a record not only for the class, but for the breed as well. The previous leader was Glencairn Brownie, owned by Mr. A. Montgomerie, of Kauwhata, with 728·05 lb. of butterfat, so that Floss of Braeside has raised the class-leadership production by no less than 104·72 lb.

Floss of Braeside was bred by Mr. W. F. Olson, of Egmont Village. In August, 1925, she commenced a C.O.R. test in the ownership of Messrs. Robertson and Blackley, New Plymouth, and on that test, starting at 5 years 275 days, gained a certificate for 678·58 lb. of butterfat. These two outstanding performances, coming so close together, mark Floss of Braeside as a cow of strong constitution as well as high productive ability. A feature of her record is the high milk-yield for an Ayrshire, her final credit being 20,305·5 lb. milk.

ANOTHER 1,000 LB. FRIESIAN.

The cow Rosevale Queen Sylvia Triumph, owned by Messrs. North and Sons, of Omimi, is well known to Friesian breeders on account of her consistently high performances under certificate-of-record test. As a junior two-year-old she gained a C.O.R. for 621·23 lb. butterfat. The following year she was withdrawn at 242 days, but gained her C.O.R. for 589·60 lb. fat prior to withdrawal. Then, again, at 5 years 104 days, she just failed to reach the 1,000 lb. level, her yield being 986·06 lb. When she was placed on test again the following year—1927-28—her performance was watched with keen interest, in anticipation of her passing the 1,000 lb. mark. As will be seen, she has yielded no less than 1,055·25 lb. of butterfat from 25,453·8 lb. of milk in 365 days, her commencing-age being 6 years 189 days. Unfortunately, she could only receive a second-class C.O.R., having failed to calve within the period for a first-class C.O.R. by the narrow margin of four days. It may be mentioned that the period allowed between calving for commencement of test and calving subsequent to test for a first-class C.O.R. is 455 days, while Rosevale Queen Sylvia Triumph was 459 days between these calvings.

Practically every name in the pedigree of Rosevale Queen Sylvia Triumph is one which high production has made familiar. Her sire is

Rosevale Plus Triumph, and her dam Rosevale Queen Daphne, who has gained certificates for 509 lb., 675 lb., and 805 lb. butterfat. Rosevale Plus Triumph is a son of Rosevale King Sylvia, who in turn is a son of Netherland King of Rosevale and Burkeyje Sylvia Posch. Netherland King of Rosevale is by Longbeach Van Tromp, and Burkeyje Sylvia Posch is by Inka Sylvia Beets Posch, so that one has here a combination of Dutch and American strains. The breeding on the dam's side is somewhat similar, as Burkeyje Sylvia Posch and Netherland King of Rosevale also appear in that half of the pedigree.

LIST OF RECORDS, NOVEMBER, 1928.

*Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Te Ngutu Memory ..	J. Murray, Woodville ..	2 7	241·2	365	11,852·1	647·28
Dominion Treasure Lass	Ruakura Farm of Instruction, Hamilton	1 362	240·5	365	11,302·5	614·87
Te Ngutu Irene ..	J. Murray, Woodville ..	1 361	240·5	365	11,745·8	585·96
Craigalea Isobel ..	J. G. Robertson, Eltham ..	2 55	246·0	365	10,477·1	579·01
Pelynn Mite ..	L. K. Tarrant, Ngaere ..	2 35	244·0	364	8,625·8	531·81
Oak Farm Demoiselle	G. B. Knowles, Tariki ..	1 356	240·5	365	8,177·4	501·52
Te Aute Golden Tinsel	W. Craig, Waiuku ..	1 324	240·5	365	8,903·8	501·06
Brooklyn Lady Alice	H. J. Lancaster, Glen Oroua	1 351	240·5	365	9,169·2	497·97
Te Aute Cora Bilberry	Late W. T. Williams, Pukehou	1 343	240·5	344	8,080·6	484·33
Jersey Brae Edna ..	T. Church, Te Rapa ..	1 360	240·5	365	8,690·4	479·08
Brooklyn Rose ..	H. J. Lancaster, Glen Oroua	2 17	242·2	353	9,438·3	474·88
Oak Farm Cinderella	G. B. Knowles, Tariki ..	1 335	240·5	365	7,783·0	465·87
Oak Farm Wanda ..	G. B. Knowles, Tariki ..	1 332	240·5	365	7,601·8	454·32
Jerseydale Dearest ..	John Pettigrew, Pihama ..	2 2	240·7	365	9,137·4	453·33
Hero's Flora ..	L. R. Fuller, Greenmeadows	1 349	240·5	365	8,010·3	448·78
Brooklyn Rosary ..	H. J. Lancaster, Glen Oroua	2 30	243·5	365	7,390·0	446·44
Beechlands Sweetbread	H. Robson, Koromatua ..	2 52	245·7	365	6,851·8	443·12
Edgarley Supreme ..	T. A. Millear, Tuakau ..	2 61	246·6	365	7,365·9	422·56
Jerseydale Trilby ..	J. Pettigrew, Pihama ..	1 343	240·5	365	7,275·9	418·19
Jersey Lea Minnie ..	T. Church, Te Rapa ..	1 348	240·5	271	7,022·2	407·42
Brooklyn Peggie ..	H. J. Lancaster, Glen Oroua	2 14	241·9	365	5,672·6	405·66
Green View Briar Rose	G. Taylor, Ngarua ..	1 132	240·5	365	7,144·9	402·18
Jersey Brae La Belle	R. Church, Te Rapa ..	1 361	240·5	357	7,398·0	401·45
Edgarley Magnolia ..	T. A. Millear, Tuakau ..	1 337	240·5	338	7,362·4	390·62
Brooklyn Wild Flower	H. J. Lancaster, Glen Oroua	1 324	240·5	365	7,211·5	389·56
Kia Ora Flandrine ..	R. E. Clements, Dargaville	2 4	240·9	361	6,969·4	388·94
Palmdale Golden Magnet	D. Kennedy, Morven ..	1 333	240·5	353	6,632·6	376·98
Fencourt Carnation ..	Johnson Bros., Mangapiko	2 28	243·3	365	7,603·5	375·00
Lammermoor Tui ..	M. G. McArthur, Auckland	2 25	243·0	365	8,338·0	362·95
Tauwhare Stella ..	Dr. C. G. Aickin, Auckland	2 22	242·7	353	6,107·0	338·39
Stirling Irene ..	J. A. Moffat, Turiwiri ..	1 357	240·5	365	5,965·0	322·65
Lammermoor Carnation	M. G. McArthur, Auckland	2 3	240·8	365	5,651·8	285·20
Brentwood Duchess ..	C. A. Willis, Pukekohe ..	1 354	240·5	340	4,037·5	270·97
Senior Two-year-old.						
Brooklyn Lady Meg	H. J. Lancaster, Glen Oroua	2 305	271·0	365	9,852·8	587·90
Brookley Gipsy ..	W. Johnson, Ngaere ..	2 280	268·5	349	8,410·4	434·75
Tauwhare Sybil ..	Dr. C. G. Aickin, Auckland	2 336	274·1	365	7,582·1	429·46
Brookley Jewel ..	W. Johnson, Ngaere ..	2 114	251·9	353	7,978·0	429·32

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued*.						
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Dominion Cosmos ..	Ruakura Farm of Instruction, Hamilton	3 357	312·7	365	14,151·3	715·06
Gowanlea White Socks	J. Robb, Westmere ..	3 341	311·1	365	11,626·2	615·35
Sunhill Olga ..	F. Phillips, Otorohanga ..	3 95	286·5	354	10,198·7	574·06
Cyrilla's Queen ..	W. Johnson, Ngaere ..	3 43	281·3	365	8,347·0	468·46
Ferndale Lady Bird ..	J. J. Springgay, Gisborne ..	3 69	283·9	365	8,786·7	401·96
Willow Burn Queenie	P. S. Grant, Puerua ..	3 320	309·0	336	6,018·4	359·99
Clifton Some Chase ..	Mrs. A. Jagger, Whitford ..	3 43	281·3	336	6,350·6	350·05
Four-year-old.						
Craigalea Bonnie ..	J. G. Robertson, Eltham ..	4 346	348·1	365	12,664·3	728·58
Dominion Banksia ..	Ruakura Farm of Instruction, Hamilton	4 363	349·8	365	13,318·1	725·83
Oak Farm Gold Petal	G. B. Knowles, Tariki ..	4 360	349·5	365	10,061·3	611·91
Mature.						
Vixen's Waveney Queen	O. Aldis, Feilding ..	7 54	350·0	365	10,985·6	730·64
Vixen's Waveney Girl	O. Aldis, Feilding ..	6 345	350·0	365	10,727·4	667·10
Sultan's Ixia ..	R. Harper, Otorohanga ..	5 4	350·0	365	11,109·4	587·70
Brentwood Favourite	C. A. Willis, Pukekohe ..	5 5	350·0	358	8,029·8	535·84
Fernaig Fay ..	J. A. Moffat, Turiwiri ..	6 278	350·0	365	9,025·2	485·85
Hesba	R. Harper, Otorohanga ..	5 358	350·0	365	8,124·0	485·45
Lakeside Mabel ..	James Paul, Toa Toa ..	7 30	350·0	268	10,320·4	466·33
Jersey Meadows Iris..	H. H. Phillips, Te Rehunga	9 47	350·0	263	7,693·6	406·76
FRIESIANS.						
Junior Two-year-old.						
Dominion Magnolia ..	Central Development Farm, Weraroa	2 24	242·9	363	10,910·3	400·67
Dominion Queen Chloe	Central Development Farm, Weraroa	2 42	244·7	365	11,206·9	358·68
Dominion Manoa ..	Central Development Farm, Weraroa	2 38	244·3	361	8,282·1	268·50
Senior Two-year-old.						
Rosevale Sylvia Plus Keyes*	North and Sons, Omimi ..	2 224	262·5	365	17,866·1	619·98
Dominion Olga May Echo	Central Development Farm, Weraroa	2 330	273·5	365	13,680·4	498·70
Dominion Sylvia Mercedes	Central Development Farm, Weraroa	2 335	274·0	326	12,938·0	447·59
Dominion Carnation of Weraroa	Central Development Farm, Weraroa	2 324	272·9	365	12,787·4	443·97
Senior Three-year-old.						
Rosevale de Kol Plus*	North and Sons, Omimi ..	3 227	299·7	365	20,216·7	610·40
MILKING SHORTHORNS.						
Senior Three-year-old.						
Dominion Promise of Ruakura	Ruakura Farm of Instruction, Hamilton	3 345	311·5	338	11,306·1	473·06
Dominion Vida of Ruakura	Ruakura Farm of Instruction, Hamilton	3 316	308·6	330	9,249·0	410·46
Dominion Hillcrest of Ruakura	Ruakura Farm of Instruction, Hamilton	3 360	313·0	326	8,458·7	349·70

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	MILKING SHORTHORNS—*continued.*					
Senior Four-year-old.		Yrs. dys.	lb.		lb.	lb.
Dominion Dellfree of Ruakura	Ruakura Farm of Instruction, Hamilton	4 329	346·4	350	9,935·2	409·66
Mature.						
Dominion Conceit of Ruakura	Ruakura Farm of Instruction, Hamilton	8 336	350·0	365	16,255·1	727·35
Matangi Mary 5th ..	Ranstead Bros., Matangi ..	5 314	350·0	365	15,945·5	556·40
	AYRSHIRES.					
Mature.						
Floss of Braeside ..	W. Moore, Homebush ..	7 287	350·0	365	20,305·5	832·72
	RED POLLS.					
Two-year-old.						
Dominion Constantia	Central Development Farm, Weraroa	2 29	243·4	365	5·742·2	251·35
	Second-class Certificates.					
	Friesians.					
Mature.						
Rosevale Queen Sylvia Triumph*	North and Sons, Omimi ..	6 189	350·0	365	25,453·8	1,055·25

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 20th September to 29th November, 1928, in lude the following of agricultural interest :—

No. 57091 : Teat-cup inflation ; A. Cranswick, Tolaga Bay. No. 59266 : Driving cheese-curd agitator ; J. B. MacEwan and Co., Ltd., Wellington. No. 60559 : Shearing-machine comb-plate ; W. G. Maw, Sydney, N.S.W. No. 59115 : Method of dressing flax ; F. T. F. Evans, Auckland. No. 59162 : Harrow ; H. R. Clover, Waitakaruru. No. 59181 : Regenerating or cleansing cream ; A. D. Cave, Wanganui. No. 59232 : Potato-planter ; P. and D. Duncan, Ltd., Christchurch. No. 59361 : Cooling milk ; W. H. Harris Tinsmiths, Ltd., Christchurch. No. 59649 : Cream-separator ; A. J. Squire, Kaikohe. No. 60150 : Automotive plough ; Squire Autoplough Tractor Co., Ltd., Sydney, N.S.W. No. 60408 : Manure-distributor ; A. Macpherson, Kohi. No. 60678 : Drying casein ; N.Z. Co-operative Dairy Co., Ltd., Hamilton. No. 61044 : Container for butter ; J. Fielding and Co., Ltd., Sydney, N.S.W. No. 58725 : Butter-box-making machine ; Ellis and Burnand, Ltd., Hamilton. No. 58987 : Milking-machine installation ; J. S. Read, Christchurch. No. 60946 : Teat-cup inflation ; L. F. Fink, Onehunga. No. 59011 : Manure and seed distributor ; T. H. Groves, Eketahuna. No. 60523 : Treatment of flax ; W. O. Beere, Wellington. No. 60580 ; Egg-carton ; L. Benoit, Chicago, U.S.A. No. 59088 : Manure-distributor ; W. H. Franks, Riverlea. No. 59477 : Manure-distributor ; W. P. Simpson, Mauku. No. 59705 : Chaff-cutting and grain-separating machine ; H. G. Groube, South Morang, Vic. No. 60370 : Teat-cup support ; O. Meuli, Patea. No. 59036 : Weed-destroying preparation ; Weed Control Co., of California, Berkeley, U.S.A. No. 59912 : Hay-sweep, L. Butler, Inglewood.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid.

LIVE-STOCK IN NEW ZEALAND, 1928.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1927–28.	Number of Lambs tailed, 1927–28.	Sheep (including Lambs) as at 30th April, 1928.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	32,617	65	465,058	202,392	18,923	850,202	405,978	902,093	90,650	655	2,231
Auckland	45,766	11	733,868	350,770	23,743	1,110,431	609,576	1,100,847	180,700	828	2,703
Gisborne	19,122	55	295,401	29,935	5,065	2,878,301	1,363,564	3,102,129	17,138	142	2,732
Hawke's Bay	15,517	3	202,779	45,512	5,904	2,709,742	1,503,987	3,077,763	17,817	2,092	2,345
Taranaki	19,815	1	356,802	196,955	10,224	793,928	403,127	814,054	64,988	23	4,377
Wellington	40,766	41	626,204	180,046	18,145	5,123,528	2,827,825	5,576,902	78,122	636	449
Nelson	6,985	3	63,486	25,337	3,479	362,071	149,442	411,178	16,792	522	856
Marlborough	6,855	9	41,046	14,320	2,031	1,005,624	430,621	1,062,147	8,149	915	2,313
Westland	2,347	..	40,206	10,929	1,531	61,088	43,510	68,805	6,734	10	180
Canterbury	58,073	46	165,745	69,991	7,968	4,238,650	2,721,197	5,266,827	58,732	64	96
Otago	33,621	8	125,423	49,299	6,599	3,102,183	1,601,861	3,684,494	27,041	4	63
Southland	25,676	8	157,751	67,243	6,057	1,722,829	1,118,284	2,066,571	20,035	5	10
Dominion totals ..	307,160	250	3,273,769	1,242,729	109,669	23,958,577	13,178,972	27,133,810	586,898	5,896	18,355
Totals 1927 (or 1926–27)	303,713	222	3,257,729	1,181,545	121,680	23,441,808	12,069,681	25,649,016	520,143	5,816	20,283

—*Census and Statistics Office.*

WEATHER RECORDS: NOVEMBER, 1928.

Dominion Meteorological Office.

GENERAL NOTES.

NOVEMBER was a dry month in most parts of the Dominion. Rainfall was above the average in the eastern districts of the North Island from Wellington to East Cape, and at scattered places in eastern parts of the South Island, but elsewhere there was a considerable deficit.

The month was on the whole cool, though summerlike conditions set in suddenly on the 16th and continued till the 25th. During this period remarkably fine weather was the rule. This year has been characterized by an unusual frequency of thunderstorms, and this feature was maintained during November, there being only twelve days on which thunderstorms were not reported by some station. Frosts were few in number and light only.

On the 1st the weather was controlled by the cyclone which had crossed the northern part of the North Island, and which was referred to in the notes for October. General rain fell over the North Island with many heavy falls. The floods in the Wairarapa and Manawatu Rivers were maintained.

On the 5th an intense depression of the westerly type brought heavy rain to the western districts and central highlands of the South Island. Northerly gales were experienced from Cook Strait southwards.

Conditions remained rather unsettled until the 12th. Between the 8th and 12th another rather intense depression passed, culminating in the development of a cyclone off East Cape. On the 8th and 9th northerly gales blew, that on the 8th being very heavy and doing much damage in Christchurch. From the 10th to the 12th there were south-westerly gales with heavy rains in most districts and low temperatures. Snow fell on the high country and hail in places. Strong southerly winds and cold showery weather continued between Napier and East Cape till the 15th, the rain being particularly heavy at East Cape.

The fine and warm spell to which reference has already been made followed the unsettled period of the first half of the month. On the 25th, however, a fairly intense cyclone approached from the Tasman Sea, and crossed the Dominion during the following two days. The passage was accompanied by good general rains, especially on the 26th, which were of great benefit to the country. Cool south-westerlies set in on the 27th as the cyclone passed, but the storm was losing intensity and the cold snap proved of only slight severity.

The remainder of the month was mainly fine with moderate temperatures.

—*Edward Kidson, Director of Meteorological Services.*

RAINFALL FOR NOVEMBER, 1928, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	2·90	11	0·74	3·27
2	Russell	1·44	9	0·69	2·52
3	Whangarei	2·50	13	0·68	3·04
4	Auckland	1·89	11	0·82	3·26
5	Hamilton	3·07	12	0·99	4·04
6	Kawhia	2·17	11	0·58	4·69
7	New Plymouth	2·63	12	0·85	4·65
8	Riversdale, Inglewood ..	6·48	13	1·98	8·95
9	Whangamomona	5·54	7	2·56	7·29
10	Eltham	4·47	11	2·06	3·35
11	Tairua	1·20	9	0·28	3·96
12	Tauranga	1·10	6	0·38	3·29
13	Maraehako Station, Opotiki	2·30	5	1·68	3·04
14	Gisborne	3·80	12	0·81	3·02
15	Taupo	5·24	10	2·01	3·43

RAINFALL FOR NOVEMBER—*continued.*

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
			North Island—continued.		
		Inches.		Inches.	Inches.
16	Napier	2·88	13	1·10	2·51
17	Maraekakaho Stn., Hastings	3·62	16	1·60	2·03
18	Taihape	2·50	13	0·60	3·69
19	Masterton	4·42	14	1·13	2·73
20	Patea	3·05	10	0·76	3·91
21	Wanganui	3·69	10	1·73	3·18
22	Foxton	3·02	7	1·00	3·24
23	Wellington (Karori Reservoir)	6·01	11	2·64	3·04
			South Island.		
24	Westport	4·97	17	1·39	7·08
25	Greymouth	6·68	17	1·20	9·13
26	Hokitika	6·68	18	1·68	10·73
27	Ross	6·64	12	0·99	13·94
28	Arthur's Pass	8·88	11	1·85	15·50
29	Okuru, Westland	12·26	12	1·40	12·96
30	Collingwood	5·73	10	2·04	7·68
31	Nelson	1·50	6	0·72	2·93
32	Spring Creek, Blenheim ..	1·77	6	0·70	2·42
33	Tophouse	4·55	10	1·82	6·62
34	Hanmer Springs	3·01	10	1·01	2·93
35	Highfield, Waiau	2·18	6	0·78	2·51
36	Gore Bay	2·21	6	0·66	2·05
37	Christchurch	1·40	7	0·62	1·87
38	Timaru	1·36	10	0·66	1·96
39	Lambrook Station, Timaru	2·28	6	0·84	2·01
40	Benmore Station, Clearburn	2·16	9	0·58	2·01
41	Oamaru	0·58	8	0·16	1·93
42	Queenstown	3·40	13	0·99	2·74
43	Clyde	0·93	8	0·29	1·36
44	Dunedin	1·99	13	0·70	3·27
45	Wendon	1·75	8	0·36	2·74
46	Gore	2·29	13	0·64	3·23
47	Invercargill	2·72	15	0·60	4·40
48	Puysegur Point	5·58	15	1·12	8·36
49	Half-moon Bay (Stewart Is.)	5·13	14	0·73	6·15

FERTILIZER IMPORTATIONS: SEPTEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the three months ended 30th September, 1928 :—

Sulphate of ammonia : United Kingdom, 112 tons ; Australia, 542 tons ; Germany, 25 tons ; United States of America, 115 tons. *Basic slag :* United Kingdom, 1,684 tons ; Belgium, 6,206 tons ; Germany, 1,491 tons. *Guano :* United Kingdom, 10 tons ; Seychelle Islands, 9,387 tons ; Walpole Island, 2,896 tons ; Juan de Nova, 3,354 tons ; New Caledonia, 2,082 tons. *Rock phosphate :* Ocean Island, 6,140 tons ; Nauru Island, 23,090 tons ; Makatea Island, 3,569 tons. *Phosphates (other) :* Belgium, 950 tons ; Egypt, 1,750 tons ; Morocco, 3,125 tons. *Superphosphate :* Belgium, 27 tons ; Holland, 700 tons. *Kainit :* France, 57 tons ; Germany, 192 tons. *Muriate of potash :* France, 15 tons. *Sulphate of potash :* France, 215 tons ; Germany, 271 tons. *Potash (other) :* France, 1,036 tons ; Germany, 1,379 tons. *Sulphate of iron :* Australia, 15 tons. *Nitrate of soda :* Belgium, 30 tons ; Chile, 325 tons. *Bonedust :* India, 425 tons. *Other manures :* United Kingdom, 12 tons ; France, 1 ton ; Germany, 69 tons.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF DEFICIENCY DISEASES IN SHEEP.

"SHEEP-FARMER," Gisborne :—

I should be obliged to have answers to the following queries : (1) In connection with the treatment of sheep in sheep-sick country (Bay of Plenty hill country), is the provision of a salt lick containing sulphate of iron of any value ; and, if so, in what proportions should the mixture be made ? Can you give me any information about citrate of iron in the same connection. At what cost can a good result be obtained ? (2) In regard to lack of fertility or fecundity in ewes in Poverty Bay, is the provision of iodine effective in improving matters ; and, if so, how can the iodine be best applied ?

The Live-stock Division :—

(1) Sulphate of iron and salt as a lick has not been found to have any value in the treatment of bush sickness. Citrate of iron and ammonia is effective as a curative agent in this disease, but it must be given as a drench. When given as a lick it is found that some animals will not take it. Further, it is found that a lick made of these ingredients will not carry the citrate of iron in equal proportions, the tendency being for the iron to fall to the bottom. In bush-sick country we have found that the treatment when supplied through a lick was nothing like as effective as when the animals were drenched. This is to be regretted, as the saving of labour would be considerable. (A new method of treating sheep by means of medicated pellets placed in troughs, now under test, is referred to in the article, "Farming of Bush-sick Country," on page 410 of this issue.—ED.) Citrate of iron and ammonia is obtainable from the Inspectors of Stock, Tauranga or Rotorua, at a cost of 2s. 6d. per pound. One pound of the iron crystals is dissolved in 13½ pints of water. Three to four teaspoonfuls of the solution is a dose for a sheep. (2) With reference to the lack of fertility or fecundity, iodine has proved useful in this direction. It is used in the form of iodine of potassium, 4 oz. of which should be dissolved in water and sprinkled over 100 lb. of dried salt. After the salt is again dried it should be placed in boxes for the sheep to lick.

GROWING BULB BLOOMS FOR MARKET.

A. E. M., Motueka :—

I have a number of narcissi, jonquils, and poetaz, and should be much obliged if you would tell me how to deal with them to get the best flowers. The soil is a sandy loam and rather deficient in humus and plant-food generally. Should they be dug up every year and dried off to give them a rest ? If so, when should they be planted to come in flower at the best time for the Wellington market ? Any other information would be much appreciated.

The Horticulture Division :—

For cut blooms for the market narcissus bulbs are generally planted in beds seven rows wide, with an interval between the beds sufficiently wide for a foot-track. Make the rows 15 in. apart, and on light soil plant the bulbs 5 in. to 6 in. deep and 3 in. to 4 in. apart. The beds may be left undisturbed from three to four years. For early blooms early planting must be practised. The bulbs should be planted as soon as possible—that will be in December or January. The land you describe would be much improved if it were well stocked with humus. For fertilizer treatment apply 4 oz. bonemeal and ½ oz. sulphate of potash per square yard before planting.

MOUTHING OF YOUNG HORSE.

G.L.W., Titahi Bay :—

Please advise me how long a young horse should have the mouthing-gear on. Is it advisable to leave it on all night ?

The Live-stock Division :—

A young horse requires to be well mouthed before being first put to work. It is the usual custom to put on the mouthing-gear after the morning feed, leave it on till the midday meal, and replace it again until the evening meal. It is not advisable to leave the gear on all night. A week to ten days of such practice is generally recognized as sufficient time for the average horse, but a great deal depends on its breed, and the class of work to be done. Opinions differ in regard to the length of time, but the mouthing is an essential part of the young horse's early training.

CROP AREAS AND YIELDS, SEASONS 1926-27 AND 1927-28.

Crop.	1926–27.		1927–28.	
	Area.	Average Yield per Acre.	Area.	Average Yield per Acre.
	Acres.		Acres.	
Wheat—				
Grain	220,083	36·13 bushels	260,987	36·56 bushels.
Chaff, &c.	928	1·87 tons	1,191	2·00 tons.
Oats—				
Grain	117,326	42·58 bushels	88,223	43·66 bushels.
Chaff, &c.	255,372	1·70 tons	201,437	1·71 tons.
Barley—				
Grain	29,886	41·60 bushels	21,091	40·87 bushels.
Chaff, &c.	528	1·66 tons	661	1·83 tons.
Maize—				
Grain	10,249	47·94 bushels	10,291	46·93 bushels.
Ensilage	730	3·31 tons	549	3·23 tons.
Peas and beans	15,495	29·35 bushels	25,128	31·93 bushels.
Linseed—Seed	4,933	7·80 cwt.	5,213	6·00 cwt.
Rye-grass—Seed	42,082	424·45 lb.	23,545	444·60 lb.
Cocksfoot—Seed	9,820	189·21 lb.	11,493	173·36 lb.
Chewings fescue—Seed	9,634	225·98 lb.	10,021	267·90 lb.
Crested dogstail—Seed	9,307	159·26 lb.	8,948	236·19 lb.
Red clover and cow-grass—Seed	8,540	181·87 lb.	7,887	180·00 lb.
White clover—Seed	4,029	165·07 lb.	2,294	165·55 lb.
Other grasses and clovers—Seed	4,287	87·57 lb.	1,493	120·04 lb.
Grass and clover hay	260,674	1·85 tons.	250,984	1·76 tons.
Lucerne hay	27,781	2·40 tons.	29,257	2·44 tons.
Potatoes	24,616	4·73 tons.	21,693	5·59 tons.
Green fodder crops	219,031	..	216,702	..
Turnips	462,360	..	459,704	..
Mangolds	11,870	..	10,329	..
Onions	765	9·28 tons	793	8·70 tons.
Hops	636	1,408·14 lb.	609	1,246·68 lb.
Tobacco	224	..	690	..

—*Census and Statistics Office.*

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the four previous years, together with the actual number of lambs tailed therein, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1928 ..	8,211,878	84·61	6,948,380	..
1927 ..	7,905,432	87·28	6,899,861	7,114,057
1926 ..	7,503,200	84·35	6,329,338	6,459,775
1925 ..	7,463,735	85·64	6,391,812	6,345,218
1924 ..	7,148,949	85·00	6,049,654	6,199,881
		SOUTH ISLAND.		
1928 ..	7,322,173	87·74	6,424,887	..
1927 ..	6,926,298	86·17	5,968,979	6,064,915
1926 ..	6,445,052	84·79	5,465,361	5,609,906
1925 ..	6,251,488	78·61	4,914,046	5,090,562
1924 ..	5,927,145	87·87	5,208,378	5,267,266
		DOMINION.		
1928 ..	15,534,051	86·09	13,373,267	..
1927 ..	14,831,730	86·76	12,868,840	13,178,972
1926 ..	13,948,252	84·57	11,794,699	12,069,681
1925 ..	13,715,223	82·43	11,305,858	11,435,780
1924 ..	13,076,094	86·14	11,258,032	11,467,147

The following table gives estimates of the current (1928) season's lambing for the several sheep districts :—

Sheep District.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.
Auckland..	1,339,246	86·41	1,157,311
Napier-Gisborne	3,680,579	79·80	2,937,276
Wellington-West Coast ..	3,192,053	89·40	2,853,793
Marlborough-Nelson-Westland	727,800	78·25	569,352
Canterbury-Kaikoura ..	3,337,802	91·53	3,055,163
Otago (including Southland)	3,256,571	85·99	2,800,372
Dominion	15,534,051	86·09	13,373,267

—*Live-stock Division.*

Reputed Fertilizers and Phosphate Rocks.—None of such specimens forwarded for examination to the Department's Chemical Laboratory during the year 1927–28 was found to have any commercial value. Eleven samples of reputed guanos collected at White Island by Mr. Grange, of the Geological Survey, were analysed for fertilizer-constituents, with results which showed no sample to contain more than 3·44 per cent. phosphoric acid, or 0·49 per cent. nitrogen, while in most of the samples the amounts were much lower.

Correction.—In the specification of export half-case for pears, page 356 of last month's *Journal*, the number of cleats should be *four*, not eight.

International Institute of Agriculture Periodicals.

AS the result of an arrangement with the International Institute of Agriculture, Rome, subscribers to the *N.Z. Journal of Agriculture* can now obtain the following periodicals of the Institute at a 10-per-cent. reduction on the ordinary subscription rates :—

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NEW ZEALAND.

Department of Agriculture.

Price-list of Wines

made at

TE KAUWHATA HORTICULTURAL STATION.

Postal Address:

"The Manager, Te Kauwhata Horticultural Station, Te Kauwhata."

Wine in Case.

CLARET (dry red), per case containing 12 reputed quarts .. 25s.

FRONTIGNAC (sweet red), per case containing 12 reputed quarts 30s.

MADEIRA (sweet white), per case containing 12 reputed quarts 30s.

Wine in Bulk.

FRONTIGNAC and MADEIRA are procurable on the following terms:

	s.	d.	
100 gallons	7	6	per gallon.
75 "	7	9	"
50 "	8	0	"
25 "	8	6	"
10 "	9	0	"
5 "	9	6	"
2 "	10	0	"

These prices are for wine only; the containers must be supplied by the purchasers.

Minimum quantity sold, two gallons.

TERMS, CASH WITH ORDER.

Delivery free on rail, Te Kauwhata Railway-station. Carriage is not paid by the Department, but is made payable forward, except when goods are consigned to flag stations. In the latter case the purchaser must prepay the railage.

FREIGHT ON CONTAINERS FORWARDED FOR REFILLING MUST BE PREPAID.

Purchaser should give his full address, quantity of wine required, and also state whether he resides within a no-license area or otherwise. All cheques other than those drawn on banks at Auckland must have exchange added.

Date of Issue	Date of Issue	Date of Issue

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